MANITOU

MT6034T

Telescopic Handler

Operator/Service Manual

Catalog 50960089 Revision A

Beginning with S/N 16251

Indicator and Operation Symbols

Manitou Americas, Inc.
One Gehl Way
P.O. Box 179
West Bend, WI 53095-0179

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For parts orders contact your Manitou Americas Dealer or call:
Factory Parts Department (262) 334-6653.
Website: www.us.manitou.com / www.manitouamericasdealer.com

⚠ WARNING ⚠

THIS OPERATOR'S MANUAL IS PROVIDED FOR OPERATOR AND SERVICING USE

DO NOT REMOVE FROM THIS MACHINE

Do not start, operate or work on this machine until you have carefully read and thoroughly understand the contents of the operator's manual.

Failure to follow safety, operating and maintenance instructions could result in serious injury to the operator or bystanders, poor operation, and costly breakdowns.

If you have any questions on proper operation, adjustment or maintenance of this machine, contact your dealer or the service department of Manitou Americas Inc. before starting or continuing operation.

California Proposition 65 Warnings

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer and birth defects or other reproductive harm.

Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. **Wash hands after handling battery.**

IDENTIFICATION INFORMATION

Write your Manitou Americas Inc. Telescopic Handler serial number below.
Refer to these numbers when inquiring about parts or service from your Manitou Americas Inc. dealer.

MODEL NO.	**MT6034T**
SERIAL NO.	

The model and serial numbers for this machine are on a decal located inside the operator's station.

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Chapter 1
INTRODUCTION

The information in this Operator's Manual was written to give the owner/operator assistance in preparing, adjusting, maintaining and servicing of the Telescopic Handler. More important, this manual provides an operating plan for safe and proper use of the machine. Major points of safe operation are detailed in the **SAFETY** chapter of this manual.

Manitou Americas Inc. asks that you read and understand the contents of this manual COMPLETELY and become familiar with the machine before operating it.

This Telescopic Handler is primarily intended for use as a material handler. However, it may be equipped with an optional system: the Personnel Work Platform (PWP) System, which is intended for use when lifting personnel. When there is no other practical option available, this machine, when equipped with the PWP System, is approved for use to lift personnel, but only with an approved work platform, with the PWP System activated, and in full compliance with the "Mandatory Work Platform Safety Rules" (see SAFETY chapter).

Refer to the seperate operator's/parts manual for information related to the optional Radio Remote Boom Control System.

The use of this Telescopic Handler is subject to certain hazards that cannot be eliminated by mechanical means, but only by the exercise of intelligence, care and common sense. It is therefore essential to have competent and careful operators, who are not physically or mentally impaired, and who are thoroughly trained in the safe operation of the equipment and the handling of the loads.

Throughout this manual information is provided that is set in *italic* type and introduced by the word **IMPORTANT** or **NOTE.** Be sure to read carefully and comply with the message or directive given. Following this information will improve operating or maintenance efficiency, help to avoid breakdowns and damage, and extend the machine's life. A chart of standard hardware torques is located in the back of this manual.

A storage pocket in the back of the seat is provided for storing the Operator's Manual. After using the manual, please return it to the pocket and keep it with the unit at all times! If this machine is resold, this manual should be given to the new owner.

If this machine was purchased "used," or if the owner's address has changed, please provide your Manitou Americas Inc. dealer or Manitou Americas Inc. Service Department with the owner's name and current address, along with the machine model and serial number. This will allow the registered owner information to be updated, so that the owner can be notified directly in case of an important product issue, such as a safety update program.

"Right" and "left" are determined from a position sitting on the seat and facing forward.

The wide Manitou Americas Inc. dealership network stands ready to provide any assistance required, including providing genuine Manitou Americas Inc. service parts. All parts should be obtained from or ordered through your Manitou Americas Inc. dealer. Give complete information about the part, and include the model and serial number of the machine. Record the serial number in the space provided on the previous page, as a handy record for quick reference.

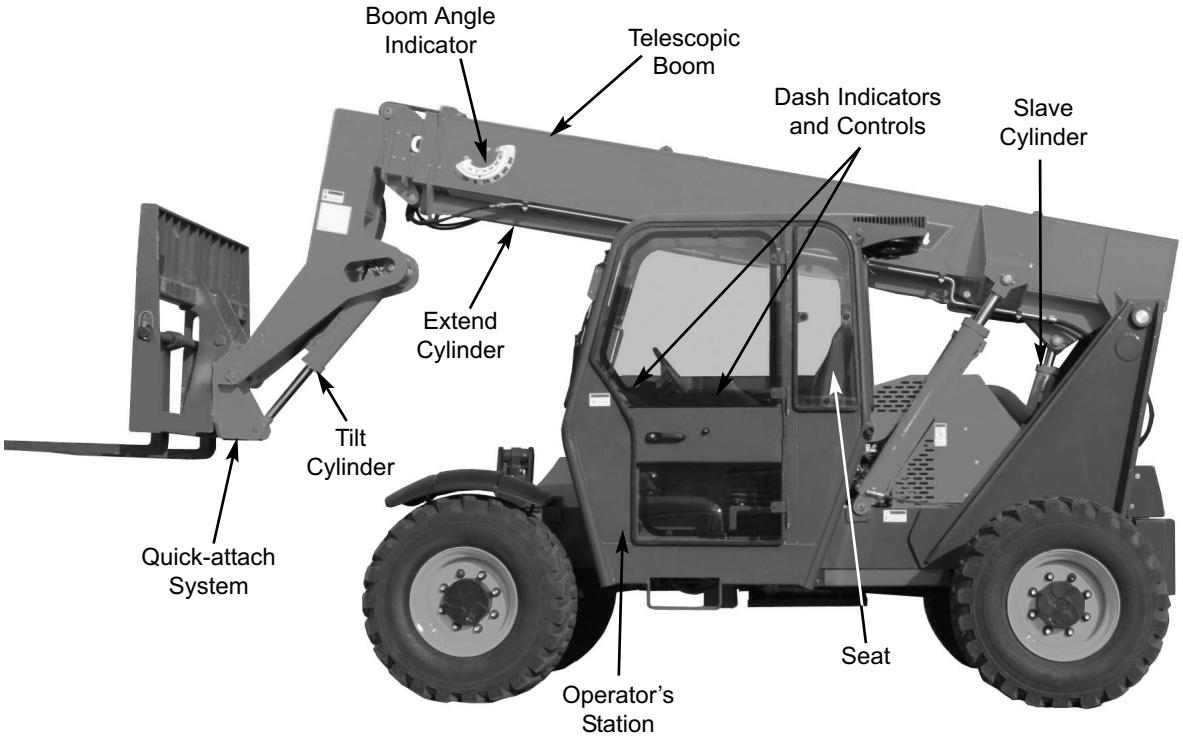
Manitou Americas Inc. reserves the right to make changes or improvements in the design or construction of any part without incurring the obligation to install such changes on any unit previously delivered.

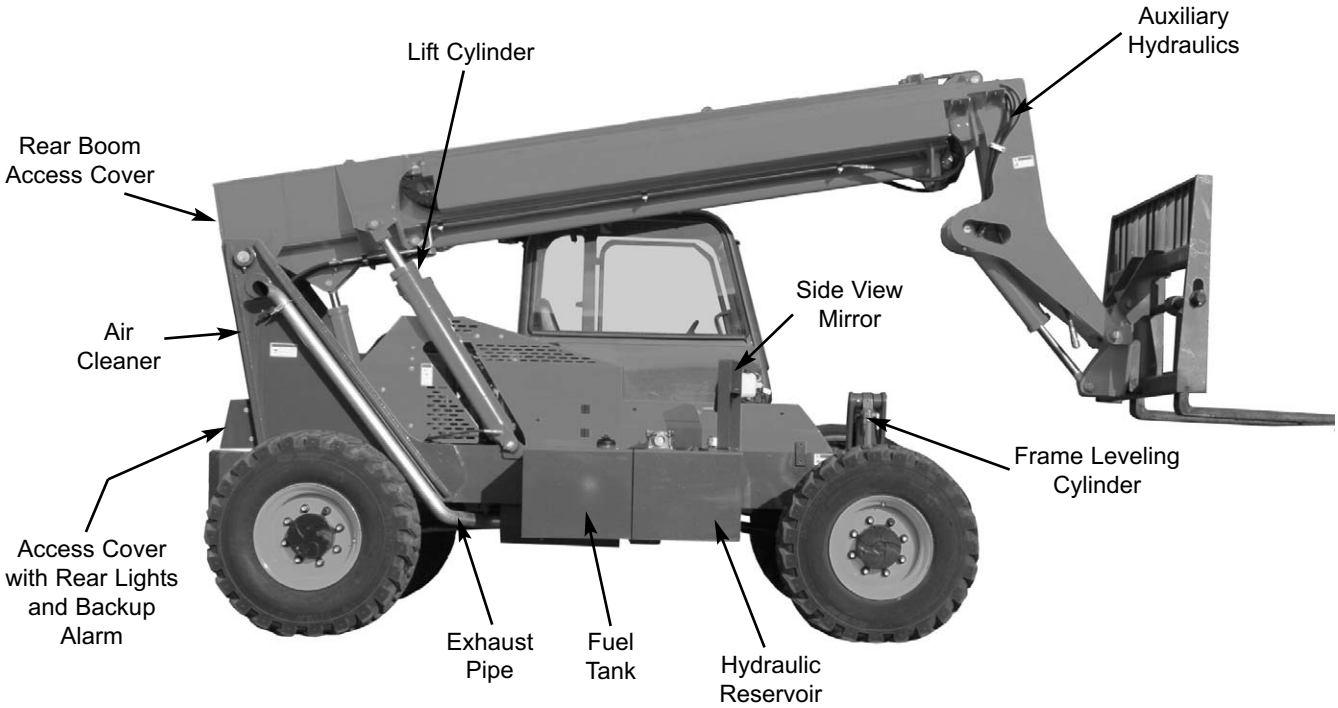
Manitou Americas Inc, in cooperation with the Society of Automotive Engineers, has adopted this

Safety Alert Symbol

to identify potential safety hazards, which, if not properly avoided, could result in injury. When you see this symbol in this manual or on the machine itself, you are reminded to BE ALERT! Your personal safety is involved!

Identification





Chapter 2

SPECIFICATIONS

Lifting Performance

Maximum lift capacity:
6000 lbs. (2721 kg)

Maximum lift height:
34’-3” (10.44 m)

Capacity at maximum lift height:
4000 lbs. (1820 kg)

Max. forward reach to load center:
23’-3” (7.09 m)

Capacity at maximum forward reach:
900 lbs. (408 kg)

Maximum below grade reach:
24” (610 mm)

Frame leveling:
10º left/10º right

General Dimensions

Based on standard machine equipped with listed tires, 48” masonry carriage and 48” pallet forks.

Recommended tire type:
15.00 x 19.5 12-ply
Inflate to 60 psi (415 kPa)

Overall length, less forks:
16’-0” (4.88 m)

Overall width:
7’-10” (2.39 m)

Overall height:
7’-9” (2.36 m)

Ground clearance: 14” (356 mm)
Wheel base: 9’-2” (2.8 m)
Outside turn radius: 12’-6” (3.81 m)

Machine weight:
15,100 lbs. (6855 kg)

Instrumentation

Multi-Function Display Screen:
Fuel level, Engine coolant temperature, Engine oil pressure, Voltmeter, Hourmeter, Maintenance reminder, Air filter restriction, and Error fault codes.

Indicator Lamps:
Low fuel, Brake failure, Transmission oil temperature, Engine pre-heat indi cator, Alternator, Engine coolant tem perature and Engine oil pressure.

Visual indicators:
Boom angle, frame angle

Steering System

Steer Valve: Fixed displacement rotary
Displacement/Rev: 17.9 cu. in. (293 cc)
System pressure: 2000 psi (138 bar)
Steer cylinders: 1 per axle
Steer mode valve:
3-position, 4-way solenoid with dash-mounted switch actuation
Steer modes: 2-wheel, 4-wheel, crab

Braking System

Service brakes: Oil-immersed inboard hydraulic wet-disc type; separate front and rear systems;
Manual foot pedal actuation

Parking brake: Spring-applied, hydraulic-release disc-type in front axle

Actuation is electric switch with engine running, automatic with engine off.

Electrical System

Type: 12-volt, negative ground
Battery: 950 cold cranking amps
Circuit protection: Fuse panel
Backup alarm: 107 dB(A)
Horn: 111 dB(A)

Standard features:
Brake lights, rear backup light, neutral start switch

Alternator: 95-amp

Service Capacities

Cooling System: 4.3 gallons (16.3 L)
50/50 mixture
Anti-freeze protection: -34ºF (-31ºC)
Pressure cap: 16 psi (110 kPa)

Fuel tank: 29 gals. (110 L)
Hydraulic reservoir and system: 35 gals. (133 L)
Transmission and cooler: 24 qts. (22.7 L)
Axles:
Differentials: 9.6 qts. (9 L) ea.
Hubs: 0.6 qts. (0.5 L) ea.

Transmission

Type: Clark Powershift T12000
Speeds: 3 fwd / 3 rev
Torque converter:
Single-stage, dual-phase

Travel Speeds:
1st gear: 3.5 mph (5.6 km/h)
2nd gear: 7.4 mph (11.9 km/h)
3rd gear: 18.0 mph (29 km/h)

Axles (front and rear)

Type: Dana
Drive/steer, open differential, double reduction planetary, full-time four-wheel drive
Overall ratio: 15.4:1

Engine Options

Features:
Turbocharged In-line 4-cycle, 4-cylinder, direct-injection diesel fuel system, in-line fuel filter w/water trap, positive pressure lubrication, liquid pressurized cooling system, 20” (508 mm) suction fan, dry dual-element air cleaner, spin-on oil filter.

Engine make and model:
Deutz TD3.6 L4 Tier 4
221 cu. in. (3.621 L) displacement
74.3 hp (55.4 kW) @ 2300 rpm
Oil capacity w/filter: 9.5 qts. (8.9 L)

Hydraulic System

Type: Open-center
Pump: Single-section gear type

Displacement / revolution:
2.7 cu. in. (44.3 cc)

Flow @ 2500 RPM:
29 gpm (110 L/min)

Main relief pressure:
3000 psi (207 bar)
Steer relief pressure:
2000 psi (138 bar)

Hydraulic filter:
In-tank return type, 10 micron media, replaceable element.
Rated flow: 100 gpm (379 L/min)
Rated pressure: 100 psi (690 kPa)
By-pass pressure (full flow):
25 psi (172 kPa)

Hydraulic strainer:
In-tank suction, 149 micron media, replaceable element.
Rated flow: 50 gpm (189 L/min)
By-pass pressure: 3 psi (21 kPa)

Chapter 3

CHECKLISTS

PRE-DELIVERY

The following Checklist is an important reminder of the inspections that MUST be made before delivering the Telescopic Handler to the customer. Check off each item after the prescribed action is taken.

√ Check that:

- ❑ NO parts of machine have been damaged in shipment. Check for such things as dents and loose or missing parts; correct or replace components as required.
- ❑ Battery is securely mounted and not cracked. Cable connections are tight. Electrolyte at proper level.
- ❑ Cylinders, hoses and fittings are not damaged, leaking or loosely secured.
- ❑ Oil, fuel and air filters are not damaged, leaking or loosely secured.
- ❑ All grease fittings have been properly lubricated and no fittings are missing; see *Lubrication* chapter of this manual.
- ❑ Wheel nuts are torqued to 450 ft.-lbs. (610 Nm).
- ❑ Tires are inflated to 60 psi (415 kPa) cold.
- ❑ Hydraulic system reservoir, engine crankcase, engine coolant, transmission and axles are filled to the proper operating fluid levels.
- ❑ All adjustments have been made to comply with the settings given in this manual and in the separate engine manual.
- ❑ All guards, shields and decals are in place and securely attached.
- ❑ Model and serial numbers for this unit are recorded in space provided on this page and page 1.

Start the machine and test-run the unit while checking that proper operation is exhibited by all controls.

√ Check that:

- ❑ All indicators (lamps, switches, etc.) function properly.
- ❑ All hand and foot controls operate properly.
- ❑ The PWP System operates properly (if equipped). Refer to *Service and Storage* chapter for the procedure to check the PWP System.
- ❑ Boom, Quick-attach™ System with attachment tool and frame level control all function properly.
- ❑ No hydraulic system leaks when under pressure.
- ❑ Listen for abnormal noises or vibrations; if detected, determine their cause and repair as necessary.

I acknowledge that the pre-delivery procedures were performed on this unit as outlined above.

_____
Dealership's Name

_____
Dealer Representative's Name

_____
Date Checklist Filled Out

_____
Machine Model # Machine Serial # Engine Serial #

DELIVERY

√ Check that:

The following Checklist is a reminder of the important information that MUST be passed on to the customer at the time the unit is delivered. Check off each item as it is explained to the customer.

- ❑ Review with the customer the contents of this manual and the AEM Safety Manual for the following:
- ❑ The *Index* at the back, for quickly locating topics;
- ❑ The *Safety*, *Indicators and Controls*, and *Operation and Adjustment* chapters for information regarding safe use of the machine.
- ❑ The *Lubrication* and *Service and Storage* chapters for information regarding proper maintenance of the machine. Explain that regular lubrication and maintenance are required for continued safe operation and long life.
- ❑ Give this Operator's Manual and the AEM Safety Manual to the customer and instruct them to be sure to read and completely understand their contents before operating the unit.
- ❑ Remind the customer of U.S. OSHA regulation 1910.178 (l), which specifies operator training requirements.
- ❑ Explain that the customer must consult the engine manual (provided) for related specifications, operating adjustments and maintenance instructions.
- ❑ Completely fill out the Owner's Registration, including customer's signature, and return it to the Company.
- ❑ Explain that a copy of the product warranty is included on the inside back cover of this Operator's Manual.

_____
Customer's Signature

_____
Date Delivered

(Dealer's File Copy - Remove at Perforation)

INTENTIONALLY BLANK

(To be removed as Dealer's file copy)

Chapter 3

CHECKLISTS

PRE-DELIVERY

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- ❑ Cylinders, hoses and fittings are not damaged, leaking or loosely secured.
- ❑ Oil, fuel and air filters are not damaged, leaking or loosely secured.
- ❑ All grease fittings have been properly lubricated and no fittings are missing; see *Lubrication* chapter of this manual.
- ❑ Wheel nuts are torqued to 450 ft.-lbs. (610 Nm).
- ❑ Tires are inflated to 60 psi (415 kPa) cold.
- ❑ Hydraulic system reservoir, engine crankcase, engine coolant, transmission and axles are filled to the proper operating fluid levels.
- ❑ All adjustments have been made to comply with the settings given in this manual and in the separate engine manual.
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- ❑ Listen for abnormal noises or vibrations; if detected, determine their cause and repair as necessary.

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Dealer Representative's Name

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Machine Model # Machine Serial # Engine Serial #

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- ❑ The *Lubrication* and *Service and Storage* chapters for information regarding proper maintenance of the machine. Explain that regular lubrication and maintenance are required for continued safe operation and long life.
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- ❑ Explain that the customer must consult the engine manual (provided) for related specifications, operating adjustments and maintenance instructions.
- ❑ Completely fill out the Owner's Registration, including customer's signature, and return it to the Company.
- ❑ Explain that a copy of the product warranty is included on the inside back cover of this Operator's Manual.

_____
Customer's Signature

_____
Date Delivered

(Pages 5 and 6 have been removed at perforation)

Chapter 4

SAFETY

The above Safety Alert Symbol means **ATTENTION! ALWAYS BE ALERT! YOUR SAFETY IS INVOLVED!** It stresses an attitude of safety awareness and can be found throughout this Operator's Manual and on the machine itself.

Before operating this equipment, read and study the following safety information. In addition, be sure that everyone who operates or works with this equipment is familiar with these safety precautions.

DANGER

"DANGER" indicates an imminently hazardous situation, which, if not avoided, will result in death or serious injury.

WARNING

"WARNING" indicates a potentially hazardous situation, which, if not avoided, could result in death or serious injury.

CAUTION

"CAUTION" indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate injury. It may also alert to unsafe practices.

Manitou Americas ALWAYS takes the operator's safety into consideration when designing its machinery, and guards exposed moving parts for his/her protection. However, some areas cannot be guarded or shielded in order to assure proper operation. Further, this Operator's Manual, the Safety Manual and decals on the machine warn of additional hazards and should be read and observed closely.

It is the responsibility of the operator to read and understand the Operator's Manual and other information provided and use the correct operating procedures. Machines should be operated only by qualified operators.

REMEMBER! It is the owner's responsibility for communicating information on the safe use and proper maintenance of this machine! This includes providing understandable interpretations of these instructions for operators who are not fluent in reading English.

MANDATORY SAFETY SHUTDOWN PROCEDURE

BEFORE cleaning, adjusting, lubricating or servicing the unit:

1. **Stop machine on a level surface. (Avoid parking on a slope, but if necessary, park across the slope and block the tires.)**
2. **Fully retract the boom and lower the attachment tool to the ground. Idle engine for gradual cooling.**
3. **Place controls in neutral and apply parking brake.**
4. **Shut off the engine and remove the key.**

ONLY when you have taken these precautions can you be sure it is safe to proceed. Failure to follow the above procedure could lead to death or serious bodily injury.

SAFETY

WARNING

U.S. OSHA regulations require employers in general industry and the construction, shipyard and cargo-handling industries (excepting agricultural operations) to ensure that forklift operators are competent, as demonstrated by successful completion of a training course.

The training course must consist of a combination of formal instruction and practical training, including both forklift-related and workplace-related topics, and evaluation of the operator's performance in the workplace.

All operator training and evaluation is to be conducted by persons who have the knowledge, training and experience to train and evaluate operators.

WARNING

ALWAYS maintain a safe distance from electric power lines and avoid contact with any electrically charged conductor or gas line. It is not necessary to make direct contact with a power line for power to ground through the structure of the machine. Keep the boom and load at least 10 ft. (3 m) from all power lines. Accidental contact or rupture can result in electrocution or an explosion. Contact the "Call Before You Dig" referral system number at 8-1-1 in the U.S., or 888-258-0808 in the U.S. and Canada, to locate any underground utility lines BEFORE starting to dig.

Additional Safety Reminders

- User/operator safety practices, as indicated by industry standards, are included in this Operator's Manual and intended to promote safe operation of the machine. These guidelines do not, of course, preclude the use of good judgment, care and common sense that may be necessary for the particular jobsite conditions.
- It is essential that operators be physically and mentally fit and free of mind-altering drugs and chemicals, and thoroughly trained in the safe operation of the machine. Such training should be presented completely to all new operators and not condensed for those claiming previous experience. Information on operator training is available from several sources, including the manufacturer.
- Some illustrations used in this manual may show doors, guards and shields open or removed for illustration purposes ONLY. BE SURE that all doors, guards and shields are in their proper operating positions BEFORE starting the engine.

Before Operation Safety Reminders

- Perform a pre-start walk-around inspection before starting the engine at the beginning of each work shift. Contact with a running engine or moving parts during the pre-start inspection could cause death or serious injury. Refer to the pre-start walk-around inspection checklist in the *"Operation and Adjustment"* chapter.
- Walk around the machine and warn all personnel who may be servicing the machine or who are in the machine path prior to starting. DO NOT start until all personnel are clearly away from the machine.
- Check brakes, steering, and hydraulic system prior to starting operation. Operate all controls to ensure proper operation. Observe all gauges and indicators for proper operation. If any malfunctions are found, correct the cause prior to using the machine.
- ALWAYS wear appropriate personal protective equipment for the job and working conditions. Hard hats, goggles, protective shoes, gloves, reflector-type vests, respirators and ear protection

are examples of types of equipment that may be required. DO NOT wear loose fitting clothing, long hair, jewelry or loose personal items while operating or servicing the machine.

- ALWAYS check the job site for terrain hazards, obstructions and people. Remove all objects that do not belong in or on the machine and its equipment.
- Manitou Americas telescopic handlers are designed and intended to be used only with Manitou Americas attachments and approved attachments. To avoid possible personal injury, equipment damage and performance problems, use attachments that are approved for use on and within the operating capacity of the machine. Contact your dealer or Manitou Americas for information on attachment approval and compatibility with specific machine models. Manitou Americas cannot be responsible if the machine is used with a non-approved attachment.

Operation Safety Reminders

- Any or all of the following elements may affect the stability of the machine: terrain, engine speed, type of load being carried and placed, improper tire inflation, weight of the attachment tool, and abrupt movement of any control lever. **IF YOU ARE NOT CAREFUL WHILE OPERATING THIS MACHINE, ANY OF THE ABOVE FACTORS COULD CAUSE THE MACHINE TO TIP, AND YOU COULD BE THROWN OUT OF THE OPERATOR'S STATION, WHICH COULD RESULT IN SERIOUS INJURY OR DEATH!**
- ALWAYS wear the seat belt provided to prevent being thrown from the machine. If you are in an overturn:
  - DO NOT jump!
  - Hold on tight and stay with the machine!
  - Lean away from the fall!
- ALWAYS keep hands, feet and arms inside of the operator's station when operating the machine!
- DO NOT depend on the backup alarm to clear bystanders out of the path of the machine. ALWAYS look in the direction of travel. Look to the rear before backing.
- ALWAYS use the recommended handholds and steps with at least three points of support when getting on and off the machine. Keep steps and platform clean. Face the machine when climbing up and down.
- DO NOT raise or drop a loaded fork or bucket suddenly. Abrupt movements under load can cause serious instability.
- Study the load chart carefully. It shows maximum capacity to be lifted and placed at specific outward and upward distances. ALWAYS be aware of load weights prior to attempting lift and placement with this machine.
- DO NOT exceed the machine's rated operating capacity for the type of attachment tool being used.
- DO NOT allow minors or any unqualified personnel to operate or be near the machine unless properly supervised.
- DO NOT start the engine or operate any controls unless properly seated in the operator's seat!
- DO NOT run the engine in an enclosed area without providing proper ventilation for the exhaust. Exhaust gases contain carbon monoxide, an odorless and deadly gas. Internal combustion engines deplete the oxygen supply within enclosed spaces and may create a serious hazard unless the oxygen is replaced. This includes the atmosphere within the cab when equipped.
- DO NOT leave the operator's station with the boom and attachment tool raised. ALWAYS lower the boom and attachment tool to the ground, shut off the engine and engage the park brake before leaving the operator's station.
- NEVER travel with the boom above the carry position (attachment tool should be at minimum ground clearance.) Boom should be fully retracted.
- DO NOT drive too close to an excavation or ditch. BE SURE that the surrounding ground has adequate strength to support the weight of the machine and the load it is carrying.

SAFETY

- DO NOT turn quickly while traveling on a slope or operate the machine beyond the grade and slope limits noted in the Operation and Adjustments chapter of the Operator's Manual.
- NEVER allow any riders on this machine. This is strictly a single-seat, NO-passenger machine.
- NEVER use as a lift for personnel unless the machine is equipped with the Personnel Work Platform (PWP) System.
- When road travel is required, know and use the signaling devices on the machine. Provide an escort and Slow-Moving Vehicle (SMV) emblem when required.
- If necessary to park on a slope, park across the slope and block the tires.

Suspended Load Safety Reminders

The handling of suspended loads by means of a truss boom, winch, boom mounted lift hook or other similar device can introduce dynamic forces affecting the stability of the machine that are not considered in the stability criteria of industry test standards. Grades and sudden starts, stops and turns can cause the load to swing and create a hazard. Refer to the following guidelines for handling suspended loads.

WARNING

U.S. OSHA regulations effective November 8, 2010 (29 CFR Part 1926, Subpart CC - Cranes and Derricks in Construction) include requirements for employers that use powered industrial trucks ("forklifts") configured to hoist (by means of a winch or hook) and move suspended loads horizontally. In particular, this regulation applies to any rough-terrain forklift (e.g., "telescopic handler") equipped with a jib or truss boom with a hook (with or without a winch), or a hook assembly attached to the forks. [Note: This regulation is in addition to the OSHA regulation that requires specific forklift operator training: §1910.178(l).]

When a forklift / telescopic handler is configured and used for hoisting, the employer must ensure that:

1. **Forklift, lift equipment and rigging have been inspected (each shift, month and year) and are in good, safe condition and properly installed.**
2. **An operator's manual and applicable load charts are on the forklift.**
3. **Work zone ground conditions can support the equipment and load. Any hazardous conditions in the work area have been identified, and the operator notified.**
4. **Equipment is being used within its rated capacity and in accordance with the manufacturer's instructions.**
5. **Operator and crew members have been trained in the safe use and operation of the equipment, including how to avoid electrocution.**
6. **During use, no part of the equipment, load line or load will be within the minimum clearance distance specified by OSHA [10 feet (3.0 m), and more for lines rated over 50 kV] of any energized power line, and any taglines used are non-conductive.**
7. **In addition, for lift equipment with a rated capacity greater than 2000 lbs. (907 kg), the employer must ensure that:**
   - **a.) An accessible fire extinguisher is on the forklift;**
   - **b.) Monthly and annual inspections are performed and documented, and records retained (three months for monthly, one year for annual);**
   - **c.) Before November 10, 2014, operators must have had the additional training and qualification / certification required by OSHA regulations §1926.1427 and §1926.1430.**

Note: Refer to the full text of the OSHA crane regulation (29 CFR Part 1926, Subpart CC) for a detailed description of the regulatory requirements.

SAFETY

- DO NOT exceed the rated capacity of the telescopic handler as equipped for handling suspended loads. The weight of the rigging must be included as part of the load.
- During transport, the length of the rigging between the attachment and load should be as short as possible to reduce booms height and movement. DO NOT raise the load more than 12 inches (305 mm) above the ground, or raise the boom more than 45 degrees.
- Only lift the load vertically – NEVER drag it horizontally.
- Use multiple pickup points on the load when possible. Use taglines to restrain the load from swinging and rotating.
- Start, travel, turn and stop SLOWLY to prevent the load from swinging. DO NOT exceed walking speed.
- Inspect rigging before use. Rigging must be in good condition and in the U.S. comply with OSHA regulation §1910.184, "Slings," or §1926.251, "Rigging equipment for material handling."
- Rigging equipment attached to the forks must be secured such that it cannot move either sideways or fore and aft. The load center must not exceed 24 inches (610 mm).
- DO NOT lift the load with anyone on the load, rigging or lift equipment, and NEVER lift the load over personnel.
- Beware of the wind, which can cause suspended loads to swing, even with taglines.
- DO NOT attempt to use frame-leveling to compensate for load swing.

Servicing Safety Reminders

- ALWAYS be aware of and avoid pinch point areas on the machine, such as wheels-to-frame, cylinders-to-frame, boom-attachment-tool-to-frame.
- NEVER attempt to by-pass the keyswitch to start the engine. ONLY use the jump-starting procedure detailed in the Service and Storage chapter.
- NEVER use your hands to search for hydraulic fluid leaks. Instead use a piece of paper or cardboard. Escaping fluid under pressure can be invisible and can penetrate the skin, causing serious injury. If any fluid is injected into your skin, see a doctor at once. Injected fluid MUST be surgically removed by a doctor familiar with this type of injury or gangrene may result.
- ALWAYS wear safety glasses with side shields when striking metal against metal. In addition, it is recommended that a softer (chip-resistant) material be used to cushion the blow. Failure to heed could lead to serious injury to the eyes or other parts of the body.
- DO NOT refill the fuel tank when the engine is hot. Allow engine to cool down before refilling to prevent hot engine parts from igniting the fuel if it should spill or splash.
- DO NOT smoke while filling the fuel tank, while working on the fuel or hydraulic systems, or while working around the battery.
- DO NOT fill the fuel tank completely. Allow room for expansion. Maintain control of the fuel filler nozzle when filling the tank. Use the correct fuel grade for the operating season.
- Static electricity can produce dangerous sparks at the fuel-filling nozzle. Do not wear polyester, or polyester-blend clothing while fueling. Before fueling, touch the metal surface of the machine away from the fuel fill to dissipate any built-up static electricity. Do not re-enter the machine but stay near the fuel filling point during refueling to minimize the build-up of static electricity. Do not use cell phones while fueling. Make sure the static line is connected from the machine to the fuel truck before fueling begins.
- Ultra-Low Sulfur Diesel (ULSD) poses a greater static ignition hazard than earlier diesel formulations. Avoid death or serious injury from fire or explosion; consult with your fuel or fuel system supplier to ensure the entire fuel delivery system is in compliance with fueling standards for proper grounding and bonding practices.

- NEVER use fuel for cleaning purposes.
- DO NOT remove the radiator cap after the engine has reached operating temperature or if it is overheated. At operating temperatures, the engine coolant will be extremely hot and under pressure. ALWAYS wait for the engine to cool before attempting to relieve pressure and remove the radiator cap. Failure to heed this warning could result in severe burns.
- DO NOT loosen or disconnect any hydraulic lines, hoses or fittings without first relieving hydraulic circuit pressure. Also, be careful not to touch any hydraulic components that have been in recent operation, because they can be extremely hot and can burn you!
- DO NOT use the boom to lift or support the machine for maintenance or service.
- Avoid lubrication or mechanical adjustments with the machine in motion or the engine operating. If the engine must be running to make certain adjustments, place the transmission in neutral, apply the parking brake, place the equipment in a safe position, securely block the tires and use extreme caution.
- To ensure continued safe operation, replace damaged or worn-out parts with genuine Manitou service parts before using this equipment.

Modifications, Nameplates, Markings and Capacities

- Modifications and additions that affect capacity or safe operation shall not be performed without the manufacturer's prior written approval. Where such authorization is granted, any applicable markings are to be changed accordingly.
- All attachment tools MUST be marked to identify the attachment tool and the total capacity with the attachment tool at maximum elevation with the load laterally centered.
- ALWAYS be sure all nameplates, warnings and instruction markings are in place and legible. Local government regulations may require specific decals, which then become the responsibility of the owner or user to provide.

Safety Guards and Warning Devices

- This machine is fitted with a Roll-Over Protective Structure (ROPS) and Falling Object Protective Structure (FOPS) in accordance with industry standards. It is intended to offer protection to the operator from falling objects, and in case of an overturn, but it cannot protect against every possible hazard. Therefore it should not be considered a substitute for good judgment and safe practices in operating the machine. If the ROPS / FOPS structure is damaged, it must be replaced to restore the protection it provides.
- This machine is equipped with a horn and backup alarm. The user must determine if operating conditions require the machine to be equipped with additional devices (mirrors, rotating beacon, etc.) and be responsible for providing and maintaining such devices.

Personnel Work Platform (PWP) System

WARNING

The machine must not be used to lift or carry personnel, or be fitted with any form of personnel work platform unless fitted with the optional PWP System.

If fitted with the PWP System, the Mandatory Work Platform Safety Rules must be followed at all times while lifting personnel.

The Mandatory Work Platform Safety Rules must be adhered to at all times while elevating personnel. These rules are based on ANSI/ITSDF Standard B56.6-2005, "Safety Standard for Rough Terrain Forklift Trucks." (A copy of this and related standards can be obtained from the Industrial Truck Standards Development Foundation, 1750 K Street NW, Suite 460, Washington DC 20009; or downloaded from: www.itsdf.org.) The rules apply to the owner, operator and the personnel in the work platform.

SAFETY

MANDATORY WORK PLATFORM SAFETY RULES

1. The work platform must comply with ANSI/ITSDF B56.6-2005, Sec. 8.24, “Platforms for Elevating Personnel.” (See page 14, “Work Platform Design Requirements.”)
2. The platform must be securely attached to the carriage or forks, and the carriage securely attached to the boom.
3. The carriage and forks must be secured to prevent them from pivoting upward.
4. If the machine is equipped with a rotating or swinging carriage, the rotation or swing must be deactivated. (This occurs automatically when the “PWP System” is switched on.)
5. Personnel on the platform must be provided protection from any moving parts on the forklift that may present a hazard.
6. If overhead hazards exist for platform personnel, overhead protection must be provided.
7. Be sure that the lifting mechanism is operating smoothly throughout its entire range, both empty and loaded, and that any lift-limiting devices and latches are functional.
8. Be sure that the frame is level, to ensure a vertical lift.
9. Be sure the platform is horizontal before lifting.
10. Be sure that the forklift has a firm footing.
11. Be sure that any required restraining means (railings, chains, harnesses, etc.) are in place and properly used.
12. Before lifting personnel, shift the transmission into Neutral, apply the parking brake, and activate the "PWP System" mode switch.
13. Before lifting personnel, the area should be marked to warn others of work by elevated personnel.
14. Be sure the path of platform travel is clear of hazards, such as scaffolds, electrical wires and overhead obstructions.
15. The operator must keep hands and feet clear of controls that are not in use.
16. Personnel must be lifted and lowered smoothly and cautiously, and only at their request.
17. The platform must be lowered fully before moving the forklift. Do not drive the forklift with personnel on the platform.
18. Elevated personnel must always be alerted before raising or lowering the platform.
19. A trained operator must be in position to operate the forklift and boom controls at all times.
20. The combined weight of the platform, personnel and load must not exceed one-third of the material-handling capacity of the forklift.
21. Platform personnel must maintain firm footing on the platform floor. A harness is to be worn and a lanyard attached to the platform or boom when working from an elevated work platform, in accordance with OSHA regulations. Use of railings, planks, ladders, etc. on platform for the purpose of achieving additional reach or height is prohibited.
22. Workers on the platform must keep all parts of their bodies inside the work platform during raising and lowering.
23. Be sure that the personnel and equipment on the platform do not exceed the available space.
24. The platform must be fully lowered for personnel to enter and exit. Personnel must not climb on any part of the forklift in attempting to enter and exit.
25. Any harness, body belt, lanyard, or deceleration device that has sustained permanent deformation or is otherwise damaged must be replaced.
26. Modifications to the platform that are detrimental to its safe use are prohibited.

SAFETY

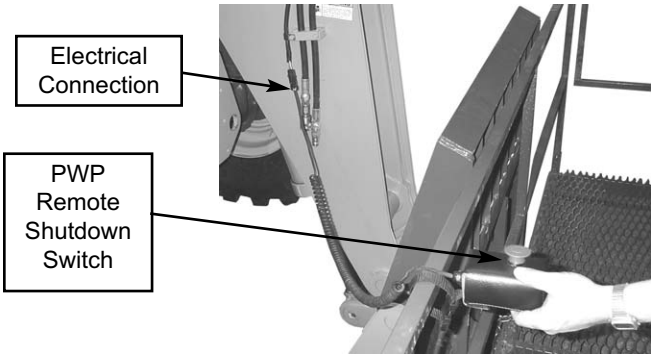
WARNING

Use ONLY an approved work platform for elevating personnel.

NEVER move the machine with the work platform in a raised position or with personnel on board.

NEVER tilt the platform forward, rearward, or to the side with personnel aboard.

ALWAYS engage the PWP System and follow the Mandatory Work Platform Safety Rules when elevating personnel.



Remote Shutdown Switch
with Coiled Wire Connector

Work Platform Design Requirements (Per ANSI/ITSDF B56.6-2005, Sec. 8.24)

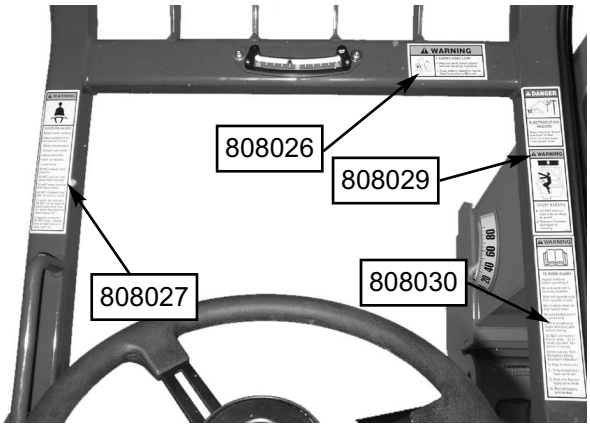
1. A platform floor having a slip-resistant surface located not more than 8 inches (200 mm) above the normal load-supporting surface of the forks.
2. Floor dimensions, which shall not exceed two times the load center distance of 24 inches (610 mm) listed on the forklift nameplate, measured parallel to the longitudinal center plane of the forklift, nor have a width greater than the overall width of the forklift [measured across the load-bearing tires] plus 10 inches (250 mm) on either side. Minimum space for each person on the platform shall not be less than 18 inches (450 mm) in either direction.
3. A 4 inch (100 mm) minimum height toe plate, which may be omitted at the access opening.
4. An overhead protective device, when requested by the user.
5. Protection for personnel in their normal working position on the platform from moving parts of the forklift that may present a hazard.
6. Information prominently indicated on the platform:
   a. maximum work load including personnel and equipment, and
   b. weight of empty platform.
7. Means so that the platform can only be centered laterally on the forklift, and retained against the vertical face of the forks, carriage or lifting mechanism.
8. A means to securely attach the platform to the lifting mechanism, and to prevent the platform from inadvertently pivoting.
9. Restraining means such as a guardrail or a means for securing personnel such as a body harness and lanyard. A guardrail or similar structure shall have a nominal height to the platform floor of 42 inches (1066 mm) around its upper periphery and include a midrail. It may be hinged, removable, or of chains, and used to provide an access opening, if proper positioning is easily accomplished and a secure condition is discernable. Such restraining

means shall be capable of withstanding a concentrated horizontal force of 200 lbs. (890 N) applied at the point of least resistance without permanent deformation. A body harness and lanyard is to have an attachment point provided overhead for freedom of movement, and its length is to limit freefall to 5 feet (1500 mm) measured from the point of attachment to the operator. The complete system shall be capable of withstanding three consecutive drop tests to simulate a 250-pound (113 kg) person falling 6 feet (1800 mm) without allowing the test weight to fall free to the ground. A deceleration device may be included.

NOTE: *Fall protection should comply with applicable U.S. OSHA regulations: 1910.67 (c)(2)(v) (for General Industry) or 1926.453 (b)(2)(v) (for Construction).*

10. Lanyards, when provided, shall be arranged so as not to cause a tripping hazard.
11. Body harnesses, when provided, should have a width of at least 1.75 inches (44 mm).
12. Structural safety factor-All load-supporting structural elements of the work platform shall have a structural safety factor of not less than 2-to-1 based on the minimum yield strength of the materials used.

SAFETY



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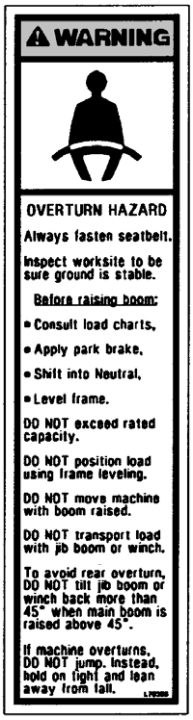
WARNING
OVERTURN HAZARD
Always fasten seatbelt.
Inspect worksite to be sure ground is stable.
Before raising boom:
• Consult load charts,
• Apply park brake,
• Shift into Neutral,
• Level frame.
DO NOT exceed rated capacity.
DO NOT position load using frame leveling.
DO NOT move machine with boom raised.
DO NOT transport load with jib boom or winch.
To avoid rear overturn, DO NOT tilt jib boom or winch back more than 45° when main boom is raised above 45°.
If machine overturns, DO NOT jump. Instead, hold on tight and lean away from tail.

808030

WARNING
TO AVOID INJURY
Inspect machine before operating it.
Be sure work tool is securely attached.
Start and operate only from operator's seat.
Use 2-wheel steer for high speed travel.
Be sure backup alarm is functioning.
Look in direction of travel and clear path before moving.
DO NOT use hands to find oil leak -- oil can inject into skin. See a doctor if injured.
Before exiting, follow Mandatory Safety Shutdown Procedure:
1) Stop in level area;
2) Fully retract boom, lower work tool;
3) Shift into Neutral, apply park break;
4) Shut off engine, remove key.

808029

DANGER
ELECTROCUTION HAZARD
Keep machine, boom and load 10 feet (3 m) or more away from power lines.
WARNING
CRUSH HAZARD
• DO NOT remove right side window or panel.
• Replace if broken, damaged or missing.
L70307

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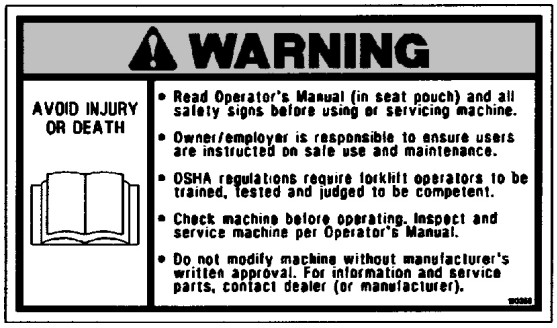
WARNING
AVOID INJURY OR DEATH
• Read Operator's Manual (in seat pouch) and all safety signs before using or servicing machine.
• Owner/employer is responsible to ensure users are instructed on safe use and maintenance.
• OSHA regulations require forklift operators to be trained, tested and judged to be competent.
• Check machine before operating. Inspect and service machine per Operator's Manual.
• Do not modify machine without manufacturer's written approval. For information and service parts, contact dealer (or manufacturer).

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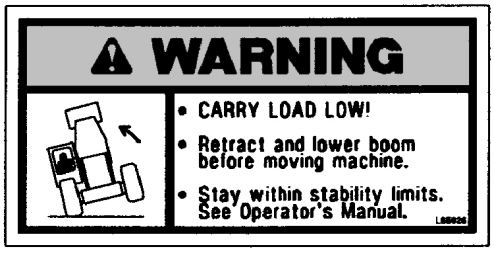
WARNING
• CARRY LOAD LOW!
• Retract and lower boom before moving machine.
• Stay within stability limits. See Operator's Manual.

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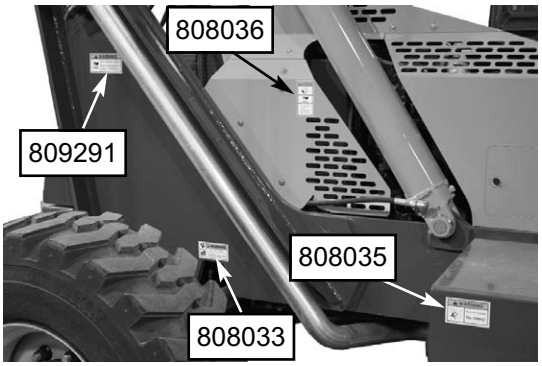
SAFETY



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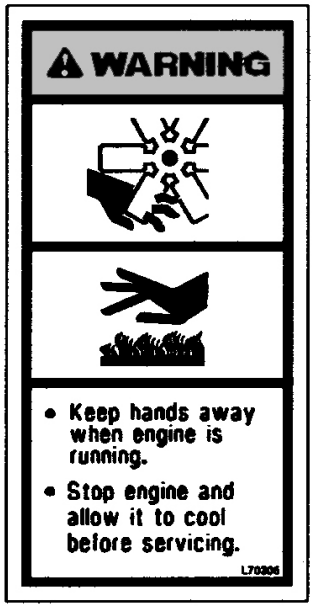

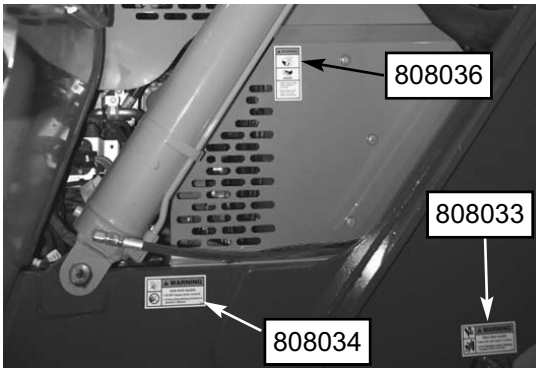

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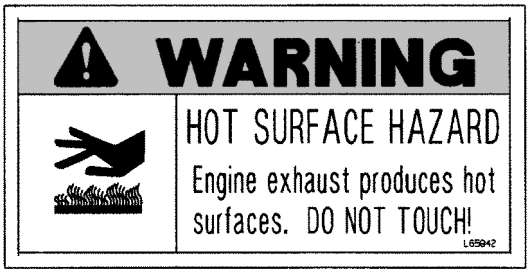

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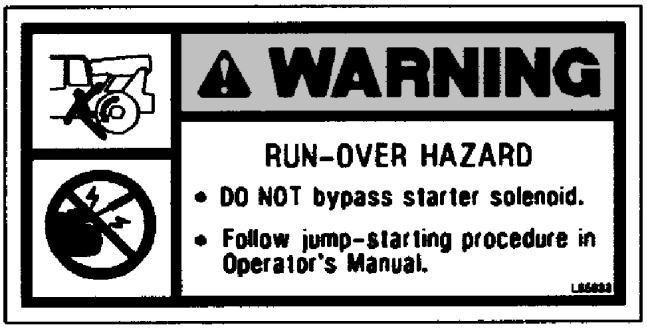

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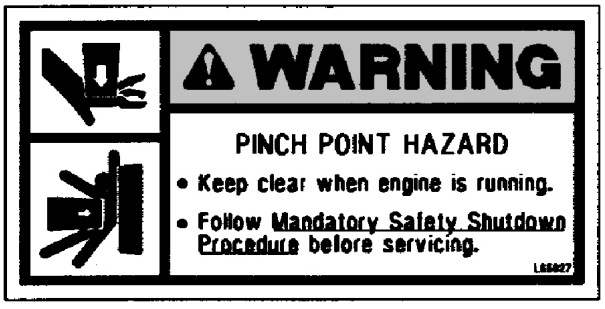
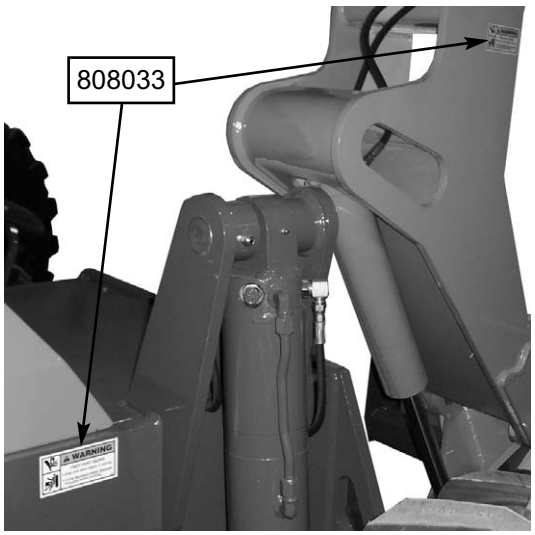

WARNING
PINCH POINT HAZARD
• Keep clear when engine is running.
• Follow Mandatory Safety Shutdown Procedure before servicing.

SAFETY



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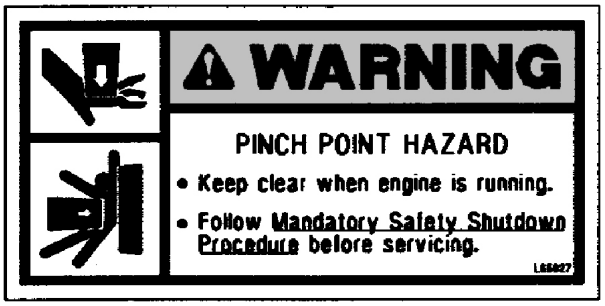
WARNING
PINCH POINT HAZARD
• Keep clear when engine is running.
• Follow Mandatory Safety Shutdown Procedure before servicing.
L65927

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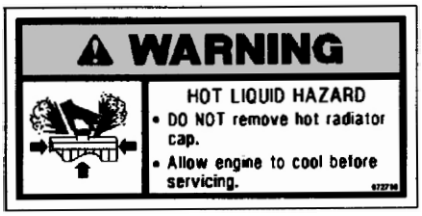

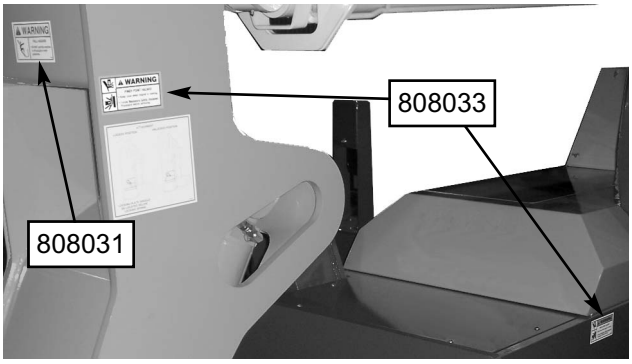

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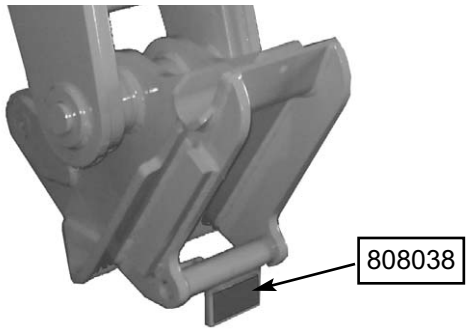

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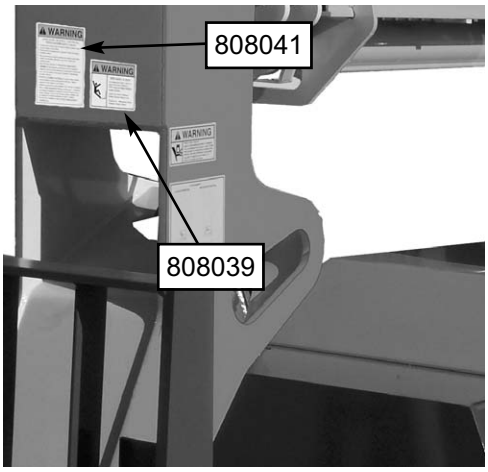
RED

SAFETY

PWP Safety Decals



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NOTE

WORK PLATFORM SYSTEM

To activate / deactivate work platform system:

1) Actuate red switch

2) Apply service brakes for 3 or more seconds, until lamp in switch stops flashing.

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WARNING

FALL HAZARD

- Lift personnel ONLY with an approved work platform, using the Work Platform Safety System.
- Check the Work Platform Safety System before use.
- Follow ALL Mandatory Work Platform Safety Rules.

L71554

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WARNING

AVOID INJURY OR DEATH -- FOLLOW ALL WORK PLATFORM SAFETY RULES:

- Connect and secure "PWP System" upper control before being lifted.
- Personnel and equipment on platform must not exceed available space.
- Be sure that any required restraining means (guardrails, chains, harnesses, lanyards, etc.) are in place and properly used.
- Any harness, lanyard, or deceleration device that is damaged or permanently deformed must be replaced.
- Platform must be fully lowered for personnel to enter and exit. Do not climb on any part of forklift in attempting to enter and exit.
- Workers on platform must keep all parts of their bodies inside platform during raising and lowering. Signal operator when ready to be moved.
- Platform personnel must maintain firm footing on platform floor, unless secured by harness and lanyard. A harness and lanyard attached to platform or boom must be worn when working. Do not use railings, planks, ladders, etc. on platform to acheive additional reach or height.
- Do not ride in platform when forklift is being moved or re-positioned.

L71700

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WARNING

TO AVOID INJURY OR DEATH, FOLLOW ALL MANDATORY WORK PLATFORM SAFETY RULES:

Platform Installation Precautions

- Platform must comply with ASME/ANSI B56.6b-1998 Addenda, Sec. 8.24.
- Modifications to platform that are detrimental to its safe use are prohibited.
- Guard any components that may present a hazard to platform personnel.
- Platform must be centered on and securely attached to carriage or forks.
- Carriage must be securely attached to boom.
- Carriage and lorks must be secured to prevent them from pivoting upward.
- Provide overhead protection for platform personnel if overhead hazards exist.

Pre-Lift Precautions

- Be sure lifting mechanism is operating smoothly throughout its range, both empty and loaded, and that the "PWP System" is functioning properly.
- Any rotating or swing carriage function must be deactivated.
- Mark area to warn others of work by elevated personnel.
- Combined weight of platform, personnel, and load must not exceed one-third (1/3) of capacity of forklift.
- Be sure forklift has a firm footing.
- Shift transmission into neutral and apply parking brake.
- Be sure forklift frame is leveled, to insure a vertical lift.
- Be sure platform is horizontal.
- Be sure path of platform travel is clear of hazards, such as scaffolds, electrical wires and overhead obstructions.

Lifting Precautions

- Be sure personnel and equipment on platform do not exceed available space.
- A trained operator must be in position to operate forklift controls at all times.
- Always alert elevated personnel before moving platform.
- Lift and lower personnel smoothly and cautiously, and only at their request.
- Keep hands and feet clear of controls that are not in use.
- Always lower platform fully before moving forklift.
- Do not move forklift with personnel on platform.

Platform Personnel Precautions

- Be sure any required restraining means (railings, chains, harnesses, etc.) are in place and properly used.
- Any harness, lanyard, or deceleration device that is damaged or permanently deformed must be replaced.
- Platform must be fully lowered for personnel to enter and exit. Personnel must not climb on any part of forklift in attempting to enter and exit.
- Platform personnel must maintain firm footing on platform floor, unless secured by harness or lanyard. A harness and lanyard attached to platform or boom must be worn when working. Use of railings, planks, ladders, etc. on platform to achieve additional reach or height is prohibited.
- Workers on platform must keep all parts of their bodies inside platform during raising and lowering.

L71555

Chapter 5

INDICATORS AND CONTROLS

CAUTION

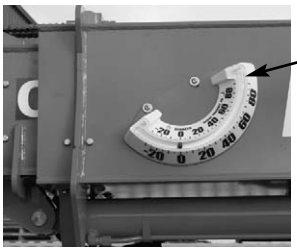
Become familiar with and know how to use ALL safety devices and controls on the Telescopic Handler BEFORE operating it. Know how to stop the machine operation BEFORE operating it. This Manitou Americas machine is designed and intended to be used ONLY with a Manitou Americas attachment tool, or a Manitou Americas approved accessory or referral attachment tool. Manitou Americas cannot be responsible for product safety if the machine is used with a non-approved accessory or attachment tool.

GUARDS AND SHIELDS

Whenever possible and without affecting machine operation, guards and shields are used to protect potentially hazardous areas. In many places, decals are also provided to warn of potential hazards and to display special operating procedures.

WARNING

Read and thoroughly understand all safety decals on the Telescopic Handler BEFORE operating it. DO NOT operate the machine unless all factory-installed guards and shields are properly secured in place.

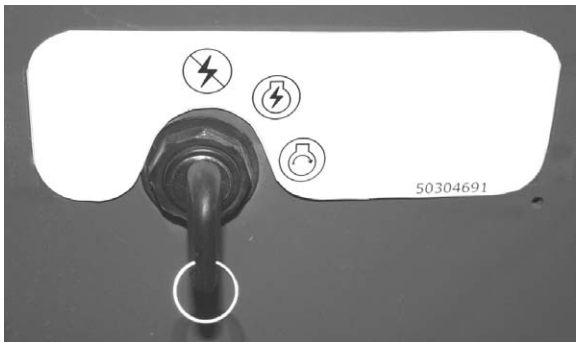


Two Joystick Controls

Tri-Function Joystick Control

Operator's Compartment and Indicators/Controls Locations

DASH PANEL AREA



Ignition Switch

Key Switch OFF: When the key is vertical in the ignition switch, power is disconnected from the battery to the control and instrument panel electrical circuits. This is the only position in which the key can be inserted and removed.

Key Switch ON: When the key is turned one position clockwise from the vertical (OFF) position, power from the battery is supplied to all controls and multi-function display panel electrical circuits. All indicator lamps in the multi-function display will illuminate momentarily as a lamp check.

When the key is in this position, the engine glow plug indicator will stay on until the engine is pre-heated. In colder temperatures the glow plug indicator will stay lit for 3-30 seconds. When the glow plug indicator light goes out the engine can be started.

Start: Turn the ignition switch to this position to activate the starter. Release the ignition switch as soon as the engine starts.

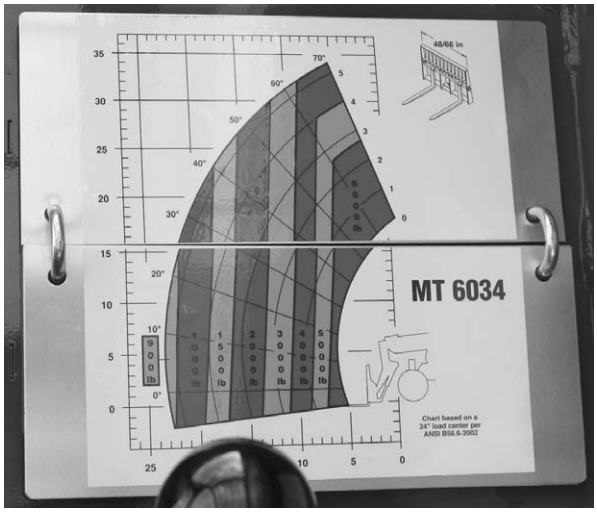
NOTE: *If the engine requires repeated attempts to start, the key MUST be returned to the OFF position between starting attempts to prevent battery run down.*

⚠ WARNING

Do not use starting fluid (ether) with engine glow plug preheat systems. An explosion can result, which can cause engine damage, injury or death.

Horn: Located in the center of the steering wheel, press the horn button to activate warning sound.

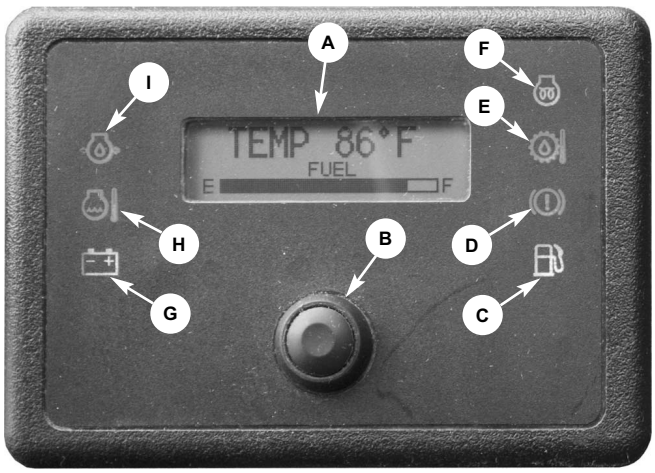
Load Zone Charts: A series of flip charts show lift height and reach limits relative to the load weight being handled with various attachment tools.



Instrumentation and Switch Panel

Located to the right of the steering wheel, this panel contains the multi-function display with indicator lamps and the function rocker switches.

Multi-Function Display with Indicator Lamps



A - Multi-Function Display Screen: This screen displays the following functions:

- fuel level displayed at all times on the lower portion of the display,

- engine coolant temperature,
- engine oil pressure,
- voltmeter
- hourmeter
- 250 hour maintenance reminder
- air filter restriction message
- error fault codes

B - Scroll Button: Pressing this button changes the function displayed in the gauge display panel.

A1 - Fuel Level Gauge: The fuel level is displayed at all times in the lower portion of the display. It indicates the amount of fuel remaining in the fuel tank.

A2 - Engine Coolant Temperature: Press button "B" until "TEMP" is displayed. It indicates the temperature of the engine coolant. Under normal conditions, this should indicate approximately 185°F (85°C).

A3 - Engine Oil Pressure: Press button "B" until "OIL" is displayed. This indicates the engine lubricating oil pressure.

A4 - Voltmeter: Press button "B" until "VOLTS" is displayed. This indicates the voltage output from the alternator.

A5 - Hourmeter: Press button "B" until "HRS" is displayed. It indicates the total operating time of the machine and should be used for keeping the maintenance log.

A6 - Maintenance Reminder: After every 250 hours a reminder will display: "ROUTINE MAINTENACE IS REQUIRED — CHECK OPERATOR'S MANUAL." Perform the required maintenance, and then clear the message by pressing and holding button "B" until the message is cleared.

NOTE: *The maintenance reminder message must display at least three minutes before it can be cleared by pressing and holding button "B".*

A7 - Air Filter Restriction: This message will appear anytime the air cleaner is restricted. Check the air cleaner for a clogged element and replace if neccessary. The message will clear when the air cleaner restriction is corrected.

A8 - Error Fault Code: Error codes and a short error description are displayed in this screen. The error code will clear when the error is corrected.

Indicator Lamps

C - Low Fuel Lamp: This lamp indicates a low fuel situation. The fuel tank should be filled as soon as possible.

D - Brake Failure Lamp: This lamp indicates the condition of the service brake systems. The front and rear brakes are on independent systems. If a loss of pressure occurs in either system during normal operation with the brake pedal depressed, this lamp will come on.

Failure in one of the brake systems does not affect the operation of the other system. However, the MANDATORY SAFETY SHUTDOWN PROCEDURE (p. 8) should be followed and any necessary repairs made immediately.

E - Transmission Oil Temperature Lamp: This lamp indicates whether or not the transmission oil is at the proper temperature. During normal operation this lamp should be off, indicating that the transmission oil system is at the proper temperature.

IMPORTANT: *If this lamp comes on during normal operation, a problem may exist in the transmission oil system. Stop the machine immediately and investigate the cause of the problem!*

F - Engine Glow Plug Indicator Lamp: When lighted this lamp indicates that the cold weather starting aid is in use.

G - Alternator Lamp: This lamp indicates the condition of the electrical charging system. During normal operation, this lamp should be off. If the charge rate is too high or too low, this lamp will come on.

H - Coolant Temperature Lamp: This lamp indicates if the temperature of the engine coolant is too high.

IMPORTANT: *If this lamp comes on during normal operation with the engine running, STOP the engine as soon as possible and check the engine cooling system.*

I - Engine Oil Pressure Lamp: This lamp indicates whether the engine lubricating oil pressure is sufficient. During normal operation, with the engine running, this lamp should be off. During starting and when the ignition is on but the engine is not running, this lamp will be on.

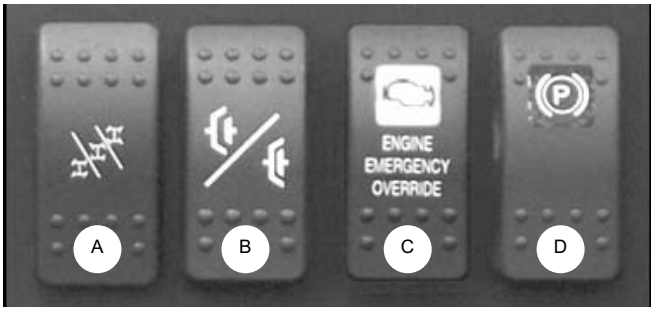
IMPORTANT: *If this lamp comes on during normal operation, stop the engine immediately! After allowing the oil to drain down for a few minutes, check the engine oil level. Maintain oil level at the FULL mark on the dipstick.*

Switch Panel

The switch panel contains three rows of switches for the operation of standard and optional equipment on the telescopic handler.

Top Row Switches

Switches have graphic symbols to indicate function and effect. The following descriptions start with the first switch on the left.



NOTE: *Some switches are optional and may not be on machine.*

A - Steering Mode: This 3-position switch is used to select among the three steering modes. The upper position engages the 4-wheel-steer mode. This mode provides all-wheel steering, used for making tighter turns, usually on a jobsite. The center position engages the 2-wheel-steer mode. This mode provides front-wheel steering only, used for higher speed travel. The lower position engages the crab-steer mode. This mode is used when a small amount of side shift is needed for picking or placing a load.

NOTE: *The rear wheels are not self-centering. Make sure all wheels are in a straight-ahead position before changing the steering mode.*

Any of the steering modes can be used in forward and reverse travel. The operator should learn to anticipate changes in machine movement if the steering mode must be changed.

B - Clutch Cutout: When activated, this switch allows faster engine acceleration and more power to the hydraulic system, without power to the drive axles, while the service brake pedal is pressed.

In the “OFF” position, the clutch mechanism of the transmission remains engaged when the brakes are applied. In the “ON” position, the clutch mechanism is disengaged when the brakes are applied.

Normal brake force will hold the machine in position while accelerating the engine to power hydraulic control functions during load placement.

C - Engine Emergency Override Switch: Pressing and holding the bottom of the engine emergency override switch will override an ECU engine shutdown signal.

The switch must be pressed within 30 seconds of the engine shutdown signal from the ECU to prevent undesired shutdown of the engine. Pressing the switch will override the engine shutdown for 30 seconds at a time to move the machine to a safe location and to lower the boom to the ground. If the engine shuts down, the ignition switch must be turned off for 30 seconds and then back on before the engine can be restarted.

NOTE: *Holding the switch continously “ON” will not reset the 30-second timer.*

Refer to the error fault code displayed in the multifunction display to determine the cause of the engine shutdown signal.

D - Parking Brake: When the machine is parked, this switch should be pressed to actuate the parking brake mechanism in the front axle.

WARNING

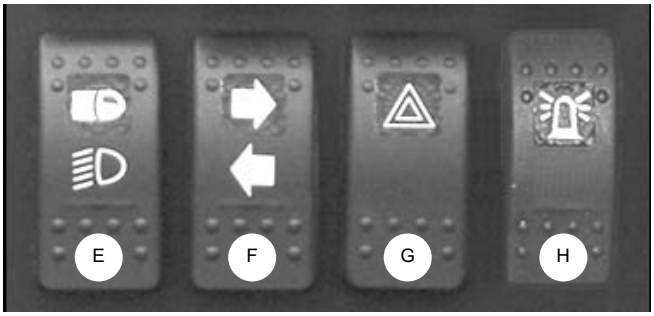
UNATTENDED MACHINE HAZARD

Activate parking brake switch and lower attachment tool to ground before leaving machine. An unattended machine can move or roll and cause death or serious injury to operator or bystanders.

Periodically check the parking brake operation to maintain adequate holding power. Always be sure the parking brake switch is off when resuming machine operation.

Middle Row Switches

Switches have graphic symbols to indicate function and effect. The following descriptions start with the first switch on the left.



NOTE: *Some switches are optional and may not be on machine.*

E - Head Lights/Work Lights: Pressing the top of the switch will illuminate the lights mounted on the top of the operator's station and the red tail lights, for use in forward travel operations. Pressing the bottom of the switch will illuminate the lights at the end of the boom in addition to the lights on the operator's station, for additional lighting in working operations.

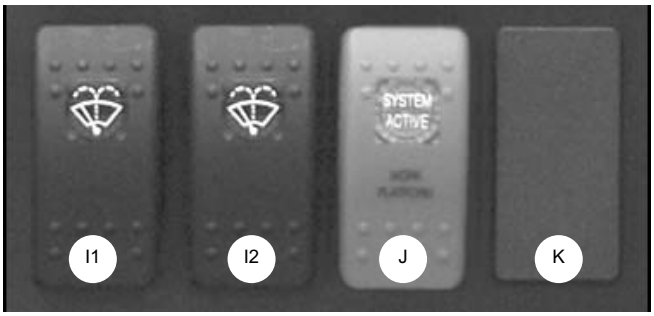
F - Turn Signal: This switch is used to indicate the direction of a turn with the tail lights. Depress the right arrow for a right turn; depress the left arrow for a left turn. Return the switch to the center position after the turn is completed.

G - Hazard: This switch can be activated to make the tail lights flash on and off in case the machine is stalled or temporarily stopped in a traffic area on the road or jobsite.

H - Strobe Light: When a stobe light is installed on the machine, activating this switch will produce a strobe light on and off flashing, for working in conditions that may obscure view of the machine.

Bottom Row Switches

Switches have graphic symbols to indicate function and effect. The following descriptions start with the first switch on the left.



NOTE: *Some switches are optional and may not be on machine.*

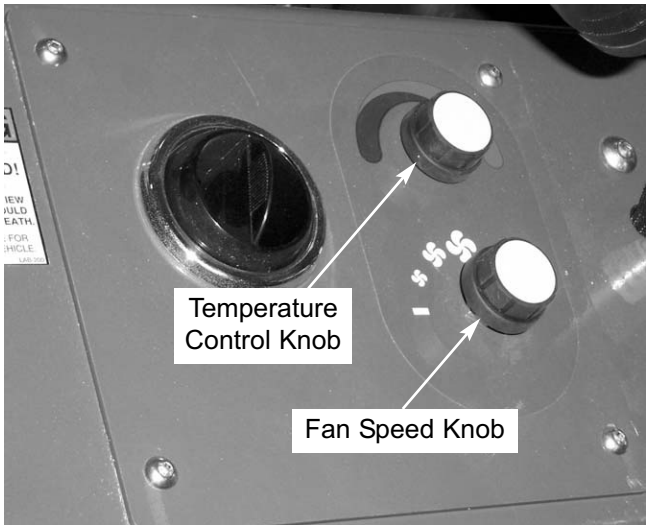
I1 and I2 - Wiper/Washer: The windshield and top window of the operator's station are each equipped with a wiper and washer mechanism. Switch "I1"operates the wiper and washer on the windshield; switch "I2" operates the wiper and washer on the top window.

J - Personnel Work Platform: This is a red switch used to activate the Personnel Work Platform (PWP) System. When activated, an amber lamp in the switch will be on.

NOTE: *This lamp will flash on and off, indicating that the system is not yet fully functional, until the brakes are held on for three or more seconds.*

K - Blank:

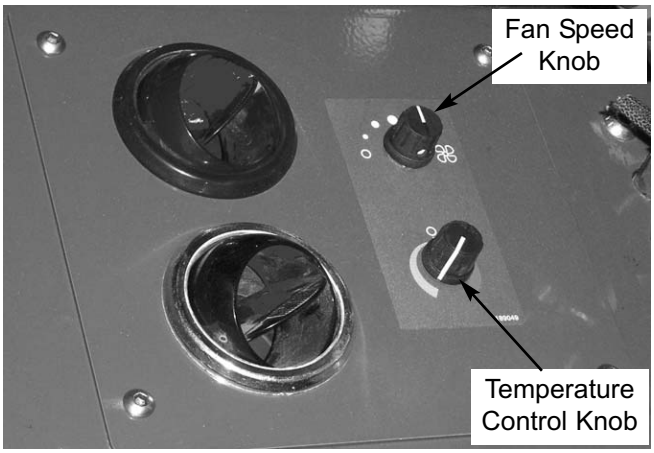
Heater Controls



Temperature Control: This is the upper knob located to the left of the steering wheel. This knob is used to adjust the temperature output of the heater. Turning the knob clockwise will increase the temperature output of the cab heater.

Fan Speed: This knob is located below the temperature control knob. Rotating the knob clockwise will increase the fan speed for increased air circulation.

Heater A/C Controls



Fan Speed: This is the upper knob located to the left of the steering wheel. The fan is in the off position when the knob is rotated completely to the left. Rotating the knob clockwise will switch the fan on and increase the fan speed for increased air circulation.

Temperature Control: This knob is located below the fan speed knob. It is used to adjust the temperature output of the heater A/C unit. Turning the knob clockwise from the midpoint position will increase the temperature output of the cab heater. Turning the knob counter-clockwise from the midpoint position will switch the A/C unit on and decrease the temperature output of the cab A/C.

Travel Lever

Located on the left side of the steering wheel column, this lever is used to change travel direction (forward or reverse) and speed.

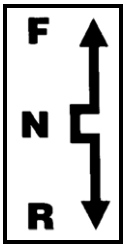
Travel Direction: The lever MUST be in "N" (Neutral) position before the starter will engage to start the engine.

NOTE: *Backup alarm automatically sounds with travel lever in "R" (Reverse).*

Position **"F"** (Forward)

Position **"N"** (Neutral)

Position **"R"** (Reverse)



Speed Range: Twisting the lever end clockwise or counter-clockwise will change the transmission speed between low, medium and travel ranges.

Position **"3"** (Travel Range)
Position **"2"** (Medium Range)
Position **"1"** (Low Range)

IMPORTANT: *Care should be taken when down-shifting or changing direction, because damage to the transmission can occur if shifting is forced or attempted at too high a speed. Allow engine speed to slow before any downshift or directional change is attempted.*

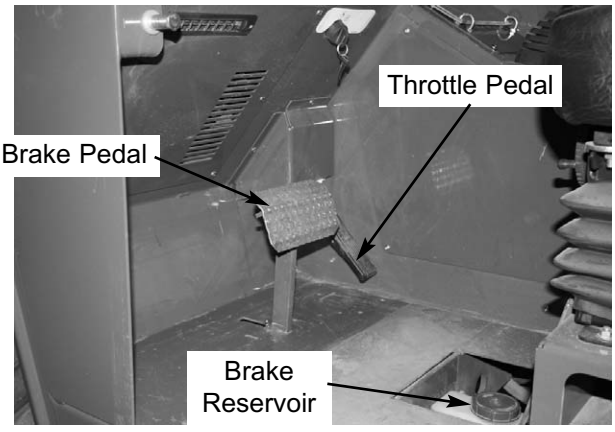
Steering

Turn the steering wheel to the right or left to turn the machine in that direction.The power steering system is designed to provide low-effort steering without shock reaction from the tires to the steering wheel.

FLOOR AND SEAT AREA

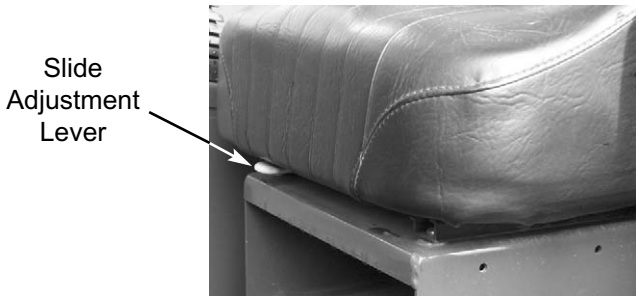
Throttle Pedal: This pedal, operated by the right foot, controls the engine speed to match power requirements. Pushing down on the pedal increases engine speed; letting up on the pedal decreases engine speed.

Service Brake Pedal: Pressing this pedal activates inboard hydraulic wet-disc-type brakes on all four wheels. Separate front and rear brake systems allow bringing the machine to a safe stop if either system loses pressure.

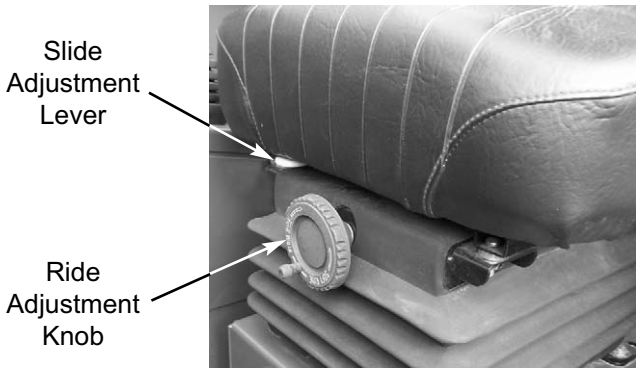


Brake Fluid Reservoirs: Located under the hinged cover on the cab floor directly in front of the seat.

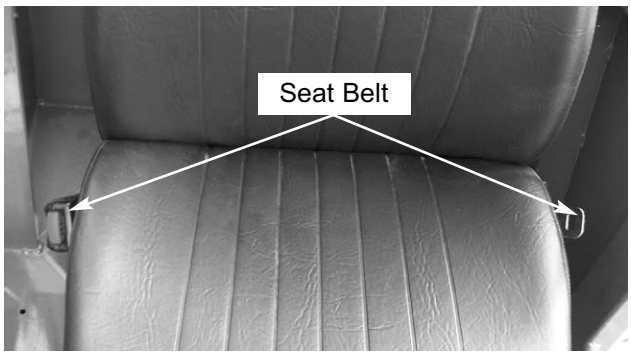
Seat Positioning: The seat is mounted on rails for forward and rearward repositioning, for comfort and to accommodate the operator's size. A spring-loaded latch handle under the front of the seat actuates the adjustment mechanism.



Suspension Seat Option: This option is available for additional operator comfort. It is adjustable for a soft or firm ride.



Seat Belt: This machine has a retractable seat belt. Grasp the belt on the left side of the seat, pull the belt over your lap, and insert the belt into the buckle on the right side of the seat until you hear it lock in place.



RIGHT SIDE PANEL

Joystick Controls: These controls and indicators are used to position the frame, boom and attachment. Graphic symbols on the side panel indicate the control actions and effect.

⚠ WARNING

Use extreme caution when raising or extending the boom. The Telescopic Handler MUST be level. Loaded or empty, the machine can tip over if it is not level.

ALWAYS place the transmission in neutral, apply the parking brake and keep the service brakes fully applied before raising or extending the boom.

NEVER exceed the specified lift and reach capacities of the machine, or serious machine damage and personal injury may result. Refer to the load charts at the operator's station or this manual.

If a boom circuit hose fails with the boom up, with or without a load, shut down the machine following the MANDATORY SAFETY SHUTDOWN PROCEDURE. DO NOT attempt repairs. Instead, call your Manitou Americas dealer for assistance.

The truss boom and winch attachment tools should ONLY be used to lift and place loads when the machine is in a stationary position. Transporting suspended loads must ALWAYS be done slowly and cautiously, with the boom and load as low as possible. Use taglines to restrict loads from swinging, to avoid overturn.

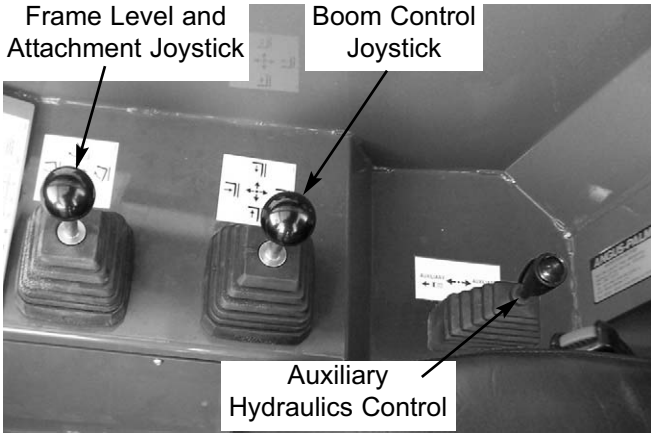
NEVER use winch for lifting or moving personnel. NEVER exceed the maximum rated capacity of the winch (3000 lbs./1360 kg) or exceed the load chart rating for winch applications.

DO NOT tilt the truss boom back more than 45º from horizontal. DO NOT attempt to use the optional rotating carriage as a load leveling function. ALWAYS level the frame prior to raising a load.

Failure to heed could result in death or serious injury.

This machine is equipped with one of two types of boom and attachment joystick control configurations, either a two-joystick configuration, or a single tri-function joystick.

Two-Joystick Configuration



Two-Joystick Configuration

Frame Level/Attachment Tilt Joystick: The machine may be tilted slowly as much as 10° to the left or right to level the frame and boom in relation to the ground. Move the joystick handle to the left to tilt to the left; move the joystick handle to the right to tilt to the right.

WARNING

DO NOT level the frame with the boom raised or extended. Level the frame ONLY while stopped, with the boom fully retracted and the attachment raised just enough to clear the ground.

To tilt the attachment tool up, move the joystick handle rearward. To tilt the attachment tool down, move the joystick handle forward.

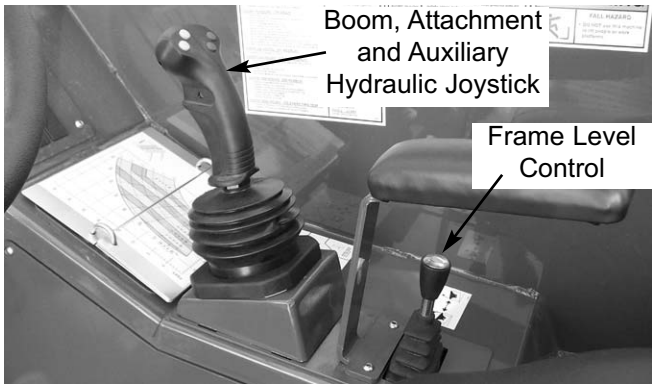
After the operator tilts the attachment tool to a desired angle, that angle will be maintained as the boom is raised and lowered, extended and retracted, until a new angle is set.

Boom Control Joystick: This machine has a hydraulic-type boom with telescopic sections. The sections extend by means of a hydraulic cylinder and chain system inside the boom, sequenced for uniform extension of each section.

To extend the boom, move the joystick handle to the right; to retract the boom, move the joystick handle to the left. To raise the boom, move the joystick handle rearward; to lower the boom, move the joystick handle forward.

Auxiliary Hydraulics Control: This two-position lever is for attachment tools that require additional hydraulics.

Tri-Function Joystick Configuration



Single Tri-Function Joystick Configuration

Tri-Function Joystick: This joystick handle is equipped with two yellow buttons and two blue buttons on the upper rear of the handle, and a trigger switch on the front of the handle. The yellow buttons operate the attachment tilt. The blue buttons operate the auxiliary hydraulics. The trigger switch increases the function speed of both the attachment tilt and auxiliary hydraulics.

To extend the boom, move the joystick to the right; to retract the boom, move the joystick to the left. To raise the boom, move the joystick rearward; to lower the boom, move the joystick forward.

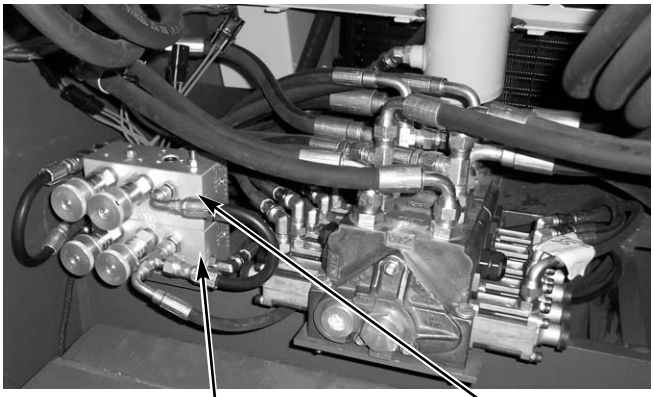
To tilt the attachment tool up, depress and hold the lower yellow button on the left side of the joystick handle; to tilt the attachment tool down, depress and hold the upper yellow button on the left side of the joystick handle.

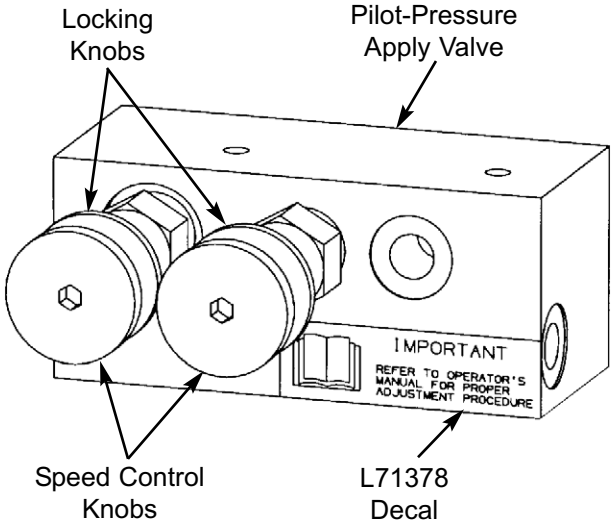
To operate the auxiliary attachment hydraulics, depress and hold either the upper or lower blue button on the right side of the joystick handle. The upper blue button will cause the reverse effect of the lower blue button.

Depressing and holding the trigger on the front side of the joystick handle will increase the speed of the attachment tilt and auxiliary hydraulic functions.

NOTE: *The joystick handle does not need to be moved to operate the tilt or auxiliary hydraulic functions.*

Speed Control Knobs: The tri-function joystick incorporates a manually adjusted speed control. Speed adjustment is accomplished through the manual adjustment of pilot-pressure apply valves located next to the main valve at the rear of the machine.





If the machine is equipped with auxiliary hydraulics, there will be two pilot-pressure apply valves, each having two speed-control knobs. The top pilot valve controls the auxiliary hydraulics, and the lower pilot valve controls the attachment tilt function. On the attachment tilt pilot valve, the left knob controls the attachment tilt-back speed, and the right knob controls the attachment tilt-forward speed. On the auxiliary hydraulic pilot valve, the function of the knobs will depend on the type of attachment requiring auxiliary hydraulics.

Turning a knob clockwise will increase the speed of its associated function. Turning a knob counter-clockwise will decrease the speed of its associated function.

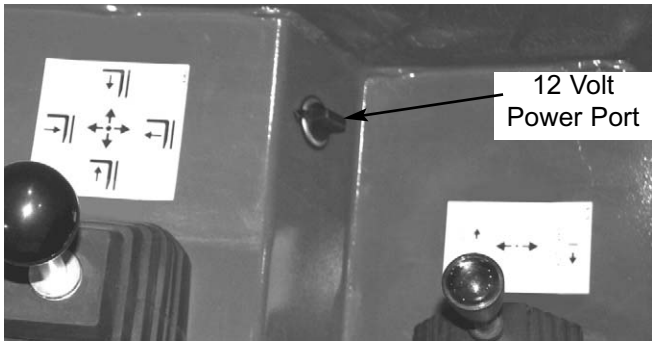
NOTE: *There is a locking knob located forward of the adjusting knob, which must be loosened before the adjusting knob can be turned. After adjustment has been made, tighten the locking knob to maintain the selected speed.*

Frame Level Control: This control is located to the rear of the tri-function joystick. The machine may be tilted slowly as much as 10° to the left or right to level the frame and boom in relation to the ground.

⚠ WARNING

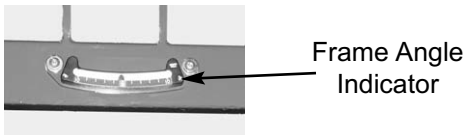
DO NOT level the frame with the boom raised or extended. Level the frame ONLY while stopped, with the boom fully retracted and the attachment raised just enough to clear the ground.

12 Volt Accessory Power Port: Use this power port to power small electrical devices.

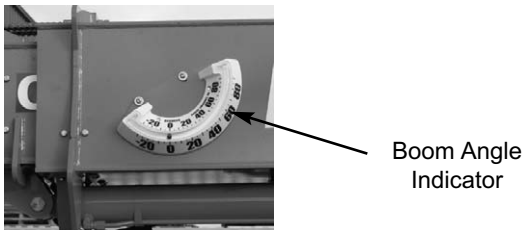


FUNCTION INDICATORS

Frame Angle Indicator: Located in front of the operator on the ROPS upper cross tube, the position of the ball indicates when the frame is level relative to a sloping ground surface.

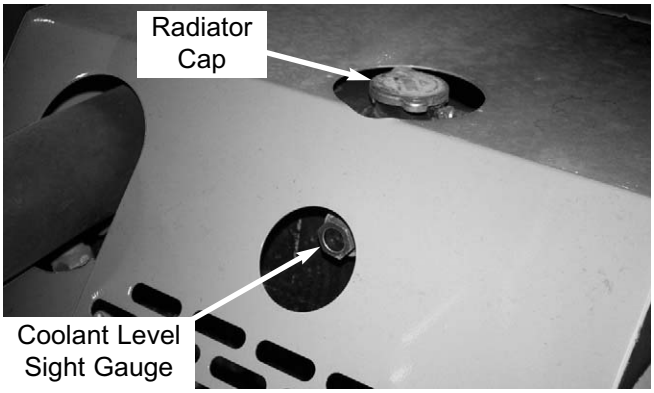


Boom Angle Indicator: Mounted on the left side of the outer boom, the movement of a ball indicates the angle of boom elevation relative to the ground.

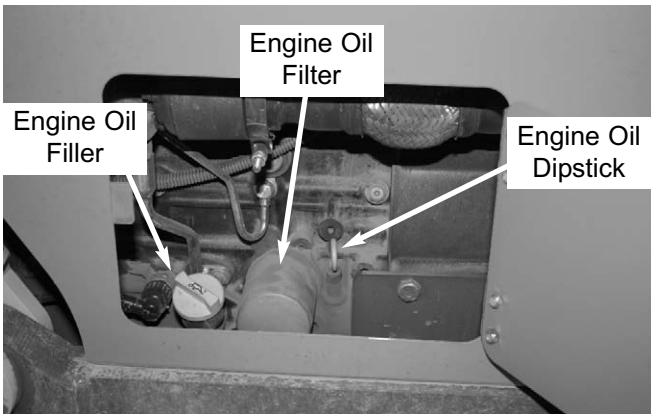


SERVICE AND SAFETY FEATURES

Coolant Level: Visually check the level of the engine coolant through the sight gauge located on the back of the radiator as shown. Remove the radiator cap to add coolant.



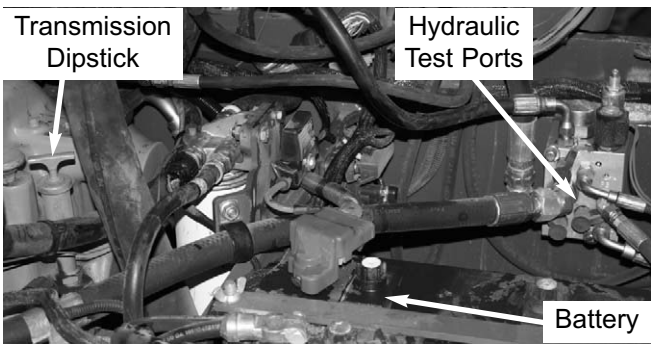
Engine Oil Level: The dipstick is located on the right side of the engine. Open the door to gain access to the engine oil dipstick, filter and filler.



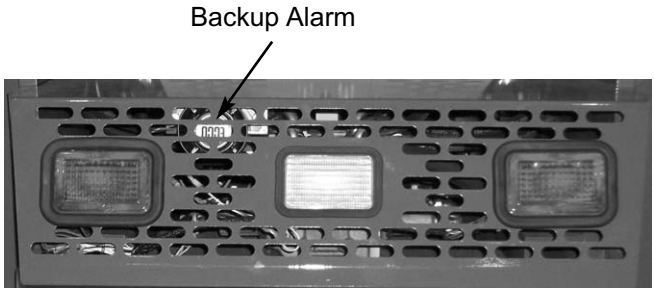
Hydraulic Pressure Test Ports: A gauge can be attached to these ports to check main valve, joystick and steering pressures.

Transmission Oil Level: The dipstick is located under the access cover on the front hood section.

Battery Compartment: The battery is located under the access cover on the front hood section.

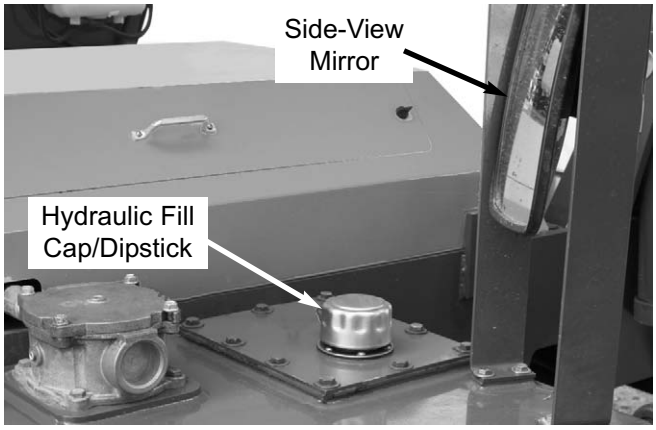


Backup Alarm: Located inside the rear frame cover, this alarm produces a loud warning sound when the machine is in reverse.



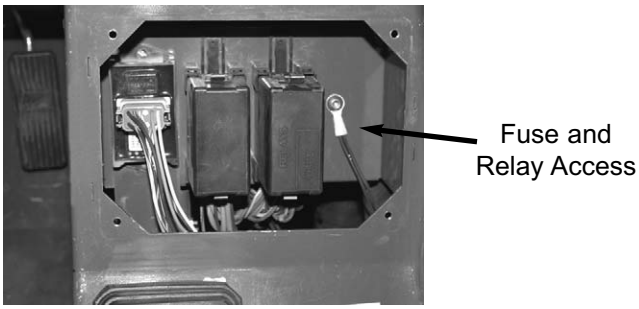
Side-View Mirror: Located on the front outside corner of the fuel tank, this mirror provides the operator with a view toward the rear of the machine.

Hydraulic Reservoir Oil Level and Fill Cap: The dipstick on the fill cap of the reservoir indicates the level of the hydraulic oil in the reservoir.

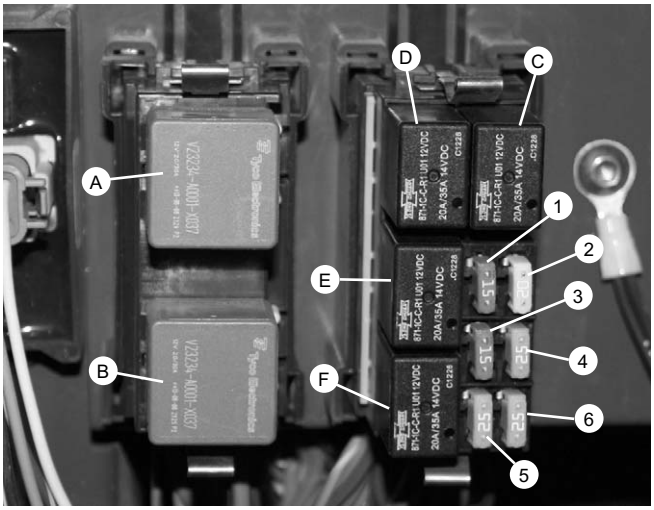


Air Filter Restriction: This message will appear in the multi-function display anytime the air cleaner is restricted. Check the air cleaner for a clogged element and replace if neccessary. The message will clear when the air cleaner restriction is corrected.

Fuse and Relay Access Compartment: This compartment is located under the load chart panel. Remove the four screws to gain access to the fuses and relays.



Fuses and Relays Functions: Remove the covers to access the fuses and relays. Refer to the illustration and following description for the fuse and relay functions.



FUSES:

1. 15 AMP fuse: Ignition Switch, Horn, Brake Lights, and Clutch Cutout.
2. 20 AMP fuse: Transmission, Park Brake, PWP, Steer Select, and Backup Alarm.
3. 15 AMP fuse: Lights.
4. 25 AMP fuse: Heater and Display.
5. 25 AMP fuse: Top Wiper Motor.
6. 25 AMP fuse: Front Wiper Motor.

RELAYS:

A. 40 AMP change-over relay: Ignition.
B. 40 AMP change-over relay: Ignition.
C. 20 AMP relay: Front Wiper.
D. 20 AMP relay: Park Brake.
E. 20 AMP relay: Lights.
F. 20 AMP relay: Top Wiper.

ATTACHMENT TOOLS

Manitou Americas offers a range of attachment tools to meet various lifting and material-handling applications. Contact your Manitou Americas dealer for specifications and ordering information.

ACCESSORIES

Manitou Americas also offers a range of special accessories for this machine. Contact your Manitou Americas dealer for specifications and ordering information.

NOTE: *All accessories are field-installed unless otherwise noted. Information and parts for installing accessories are provided by your Manitou Americas Telescopic Handler dealer or Manitou Americas.*

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Chapter 6

OPERATION AND ADJUSTMENTS

GENERAL INFORMATION

CAUTION

BEFORE starting the engine and operating the Telescopic Handler, review and comply with ALL safety recommendations in the SAFETY chapter of this manual. Know how to STOP the machine before starting it. Also, BE SURE to fasten and properly adjust the seatbelt.

ENGINE BREAK-IN

A new engine does not require extensive "break-in." However, for the first 100 hours of operation:

- Allow the engine to idle for a few minutes after every cold start.
- DO NOT idle the engine for long periods of time.
- DO NOT operate the engine at maximum power for long periods of time.
- Vary the engine speed and load.
- Check the oil level frequently, and replenish as necessary with the oil specified in the engine manual.

After the first 100 hours of operation, change the oil and replace the oil filter. Consult the *Lubrication* chapter or the engine manual for the type of oil to use in the engine. Refer to the *Service and Storage* chapter for the proper service intervals.

PRE-START WALK-AROUND INSPECTION

It is the operator's responsibility to perform a pre-start inspect of the machine before the start of each workday. Every pre-start inspection must include more than simply checking the fuel and oil levels. It is a good practice to personally inspect any machine you are assigned to use, even though it has already been put into service by other personnel.

The pre-start inspection is designed to discover if the machine has incurred any damage or is in need of routine service.

Any needed repairs are to be made by a qualified service technician.

Refer to the illustration and checklist on the next two pages for the "Pre-Start Walk-Around Inspection."

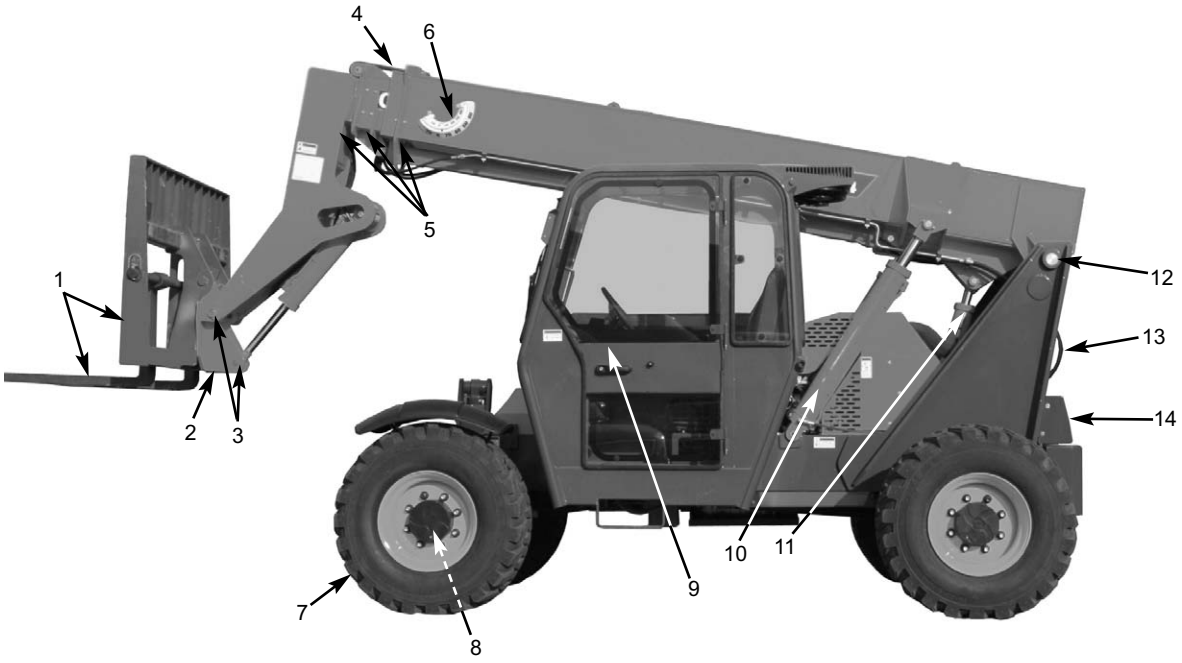
Pre-Start Walk-Around Inspection Illustration

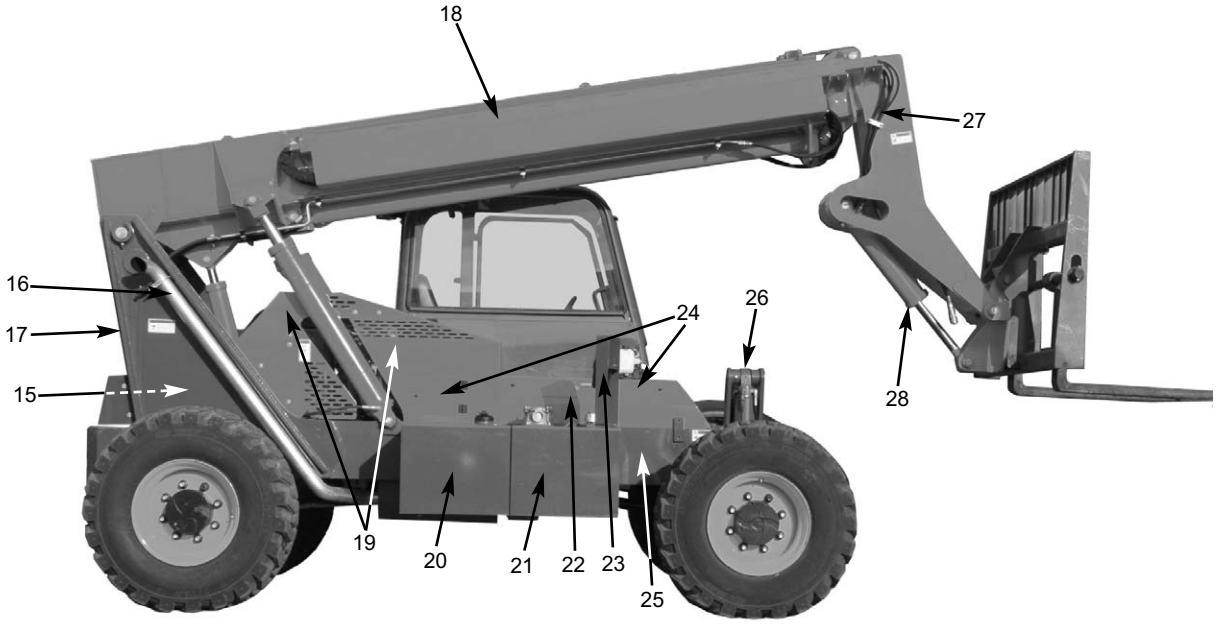
PRE-START WALK-AROUND INSPECTION PROCEDURE

Refer to the following illustration and checklist to perform the inspection. Begin with item 1 at the left front of the machine and walk toward the rear of the machine on the left side and around the back and toward the front on the right side of the machine.

Any needed repairs or service noted during the inspection must be performed by a qualified service technician before operating the machine.

The illustration and checklist page can be copied for future pre-start walk-around inspections.





Pre-Start Walk-Around Inspection Checklist

Note the condition of safety decals during the walk-around inspection. Replace missing or illegible safety decals.

☐**1.** **Attachment Tool:** Check for broken, missing or damaged parts. When using a personnel work platform, check to see if the platform meets ANSI/ITSDF standards and that it is secured to the forks and fork carriage. When using forks, check for welds, cracks or misalignment. Replace the forks in sets when the condition of the forks is questionable.

IMPORTANT: *DO NOT use forks that have been repaired by welding.*

☐**2.** **Attachment Tool Mount:** No loose or missing parts; no visible damage.

☐**3.** **Attachment Tool Mounting Pins:** No visible damage; pin fit is secure and properly lubricated.

☐**4.** **Boom Chain:** No loose or missing parts; no visible damage; sheave pin fit is secure and properly lubricated.

☐**5.** **Boom Sections and Wear Pads:** No loose or missing parts; no visible damage or excessive wear.

NOTE: *Wear pads that measure 3/8" (9.5 mm) thick or less need to be replaced.*

☐**6.** **Boom Angle Indicator:** Properly secured; no visible damage; bubble is visible.

☐**7.** **Tire and Wheel Assemblies:** Properly secured; no loose or missing lug nuts; no visible tire damage (cuts or abrasions); proper inflation.

☐**8.** **Front and Rear Axles:** No loose or missing parts; no visible damage; tie rod end studs locked; no evidence of leaking; properly lubricated.

☐**9.** **Operator Compartment:**

- ☐ Seat belt undamaged; operates properly; mounting hardware secure.
- ☐ Switches and levers undamage;
- ☐ no loose or missing parts;
- ☐ load charts properly secured and legible;
- ☐ levers and switches operate properly; control markings legible;
- ☐ frame level indicator secured and undamaged, bubble is visible.

☐**10.** **Lift Cylinder:** Properly secured; no visible damage; no evidence of leaking from the cylinder; properly lubricated.

☐**11.** **Slave Cylinder:** Properly secured; no visible damage; no evidence of leaking from the cylinder; properly lubricated.

☐**12.** **Boom Pivot Assembly:** Properly secured; no visible damage or excessive wear; properly lubricated.

☐**13.** **Boom Hydraulic Hoses:** No visible damage or exterior wear; no evidence of leaking.

☐**14.** **Rear Light Assembly:** Properly secured; no visible damage; no loose or disconnected wires; no malfunctions.

☐**15.** **Hydraulic Control Valve Assembly:** No loose or missing parts; no evidence of leaking; no damaged or leaking hoses.

☐**16.** **Exhaust System:** No loose or missing parts; no visible damage; no obstructions to the outlet.

☐**17.** **Engine Air Filter:** No loose or missing parts; no visible damage; no obstructions to the evacuator; precleaner free from dirt; restriction indicator proper reading.

☐**18.** **Boom Hose Guards:** Properly secured; no visible damage.

☐**19.** **Engine Compartment:**

- ☐ Engine oil level, add if needed;
- ☐ Coolant level, add if needed;
- ☐ No evidence of engine oil or coolant leaks;
- ☐ Belts and hoses in good condition, properly secured and adjusted

☐**20.** **Fuel Tank:** No visible damage; no evidence of leaking; level of fuel; breather cap secure and working.

☐**21.** **Hydraulic Oil Reservoir:** No visible damage; no evidence of leaking; recommended oil level; breather cap secure and working.

☐**22.** **Battery Compartment (under cover):** Proper electrolyte level; no loose or damaged cables; no visible damage or corrosion.

☐**23.** **Mirror Assembly:** No loose or missing parts; no visible damage; properly adjusted.

☐**24.** **Cowling and Latches:** All cowling, doors and latches in working condition; properly secure; no loose or missing parts; all components operate properly.

☐**25.** **Frame:** No visible damage; no cracked welds; no loose or missing parts.

☐**26.** **Frame Tilt Cylinder:** Properly secured; no evidence of leaking; properly lubricated.

☐**27.** **Tilt and Auxiliary Hydraulic Hoses:** No visible damage or excessive wear; no evidence of leaking.

☐**28.** **Attachment Tilt Cylinder:** Properly secured; no visible damage; no evidence of leaking from the cylinder; properly lubricated.

Date: _____Initials: _____

BEFORE STARTING ENGINE

Before mounting the operator's compartment, walk completely around the machine to be sure no one is under, on, or close to it. Let others in the area know you are going to start up. Wait until everyone is clear of the machine before starting it up.

Before starting the engine and running the machine, refer to the *Indicators and Controls* chapter and become familiar with the various operating controls, indicators and safety features.

STARTING THE ENGINE

⚠ WARNING

ALWAYS fasten your seat belt BEFORE starting the engine. Leave the parking brake applied until the engine is running and you are ready to operate the machine.

The following procedure is recommended for starting the engine:

1. Grasp the handholds and step up into the operator's compartment.
2. Adjust the seat and fasten the seatbelt.
3. Check that all controls are in their "neutral" positions, except the parking brake switch, which should be in the "ON" position.
4. Turn the key switch clockwise one position to the "ON" position. When the pre-heat indicator lamp in the multi-function display goes out, the engine can be started.
5. Turn the key switch clockwise until the engine starter activates. Release the key switch when the engine starts. If the key switch is released before the engine starts, turn the key switch to the "OFF" position and wait one minute before attempting to start again.

IMPORTANT: *Crank the starter until the engine starts. If the engine fails to start within 20 seconds, return the key to the "OFF" position, wait one minute, and try to start the engine. Cranking the engine for longer than 20 seconds will result in premature failure of the starter.*

5. After the engine starts, allow several minutes warm-up time before operating the controls. Allow a longer warm-up time in cold weather.
6. Check that indicators are in their normal operating conditions.
7. Verify that there are no fuel, oil or engine coolant leaks, and no abnormal noises or vibrations.

COLD STARTING PROCEDURES

The engine is equipped with a block heater. This block heater or other starting aid is required for starting in temperatures below 32°F (0°C). See your Manitou Americas dealer for additional starting aids.

WARNING

Do not use starting fluid (ether) with engine glow plug preheat systems. An explosion can result, which can cause engine damage, injury or death.

If the battery becomes discharged and has insufficient power to start the engine, jumper cables can be used for starting assistance. Refer to the jump starting instructions in the *Service and Storage* chapter of this manual for safe jump starting procedures.

STOPPING

The following procedure is the recommended sequence for stopping the machine:

1. Bring the machine to a stop on a level surface. Avoid parking on a slope, but if necessary park across the slope and block the wheels.
2. Fully retract the boom and lower the attachment to the ground.
3. Idle the engine for at least 2 minutes for gradual cooling.
4. Place controls in neutral. Apply the parking brake.
5. Turn the ignition switch key to the "OFF" position. Remove the key.
6. Unfasten the seatbelt, and grasp the handholds while climbing out of the operator's compartment.

FIRST TIME OPERATION

Make sure the engine is warm, and then go through the following procedures:

⚠ CAUTION

Be sure the area being used for test-running is clear of spectators and obstructions. Initially, operate the machine with an empty attachment tool.

Place the travel lever in Forward or Reverse and select a speed range. Switch off the parking brake and move ahead slowly, while testing the steering and brakes. Stop and operate all boom, attachment tool functions and frame leveling controls, checking for smooth response.

Apply the service brakes, stop the machine and move the travel lever to the opposite direction (forward or reverse).

Shifting to the next higher gear may be done at any engine speed while the machine is in motion.

DO NOT overspeed the engine when down-shifting. Allow the machine to slow down before shifting to the next lower gear.

ENGINE SHUTDOWN PROTECTION

The engine is equipped with a WARNING and SHUTDOWN feature to warn of critical engine related fault errors. These fault errors will be displayed in the multi-function display. If the cause of the error code is not corrected, the engine power will be reduced automatically, or the engine will shut down.

PARKING BRAKE

NOTE: *The parking brake mechanism within the front axle is not designed for, and not intended to be used as, the primary means of stopping movement of the machine. Hydraulic braking provided through the service brakes within the axles is the primary means for stopping movement. The axle-by-axle split brake system is the secondary means of stopping movement.*

The proper sequence for correct machine operation is to always engage the parking brake switch before shutting off the engine; and to disengage the parking brake ONLY after the engine is running. In an emergency however, if it becomes necessary to stop movement, activate the parking brake switch to "ON."

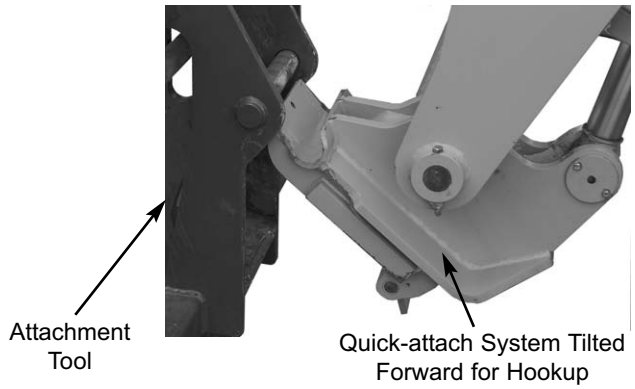
CHANGING ATTACHMENT TOOLS

The Telescopic Handler boom nose will accept Manitou Americas Quick-attach™ System attachment tools. The Quick-attach™ System has a quick-release hookup and locking mechanism for mounting framing-type or masonry-type attachment tools to the boom nose.

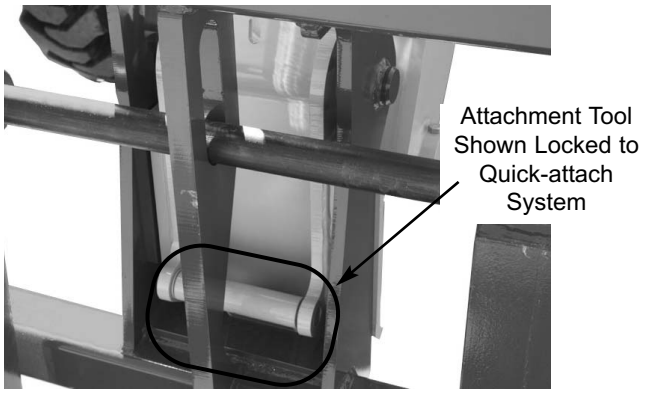
Attaching Procedure

To pick up an attachment tool, proceed as follows:

1. Raise the boom slightly, extend it two to three feet (600 to 900 mm) for better visibility, and tilt the tool carrier forward.
2. Align the tool carrier squarely with the back of the attachment tool.
3. Slowly extend the tool carrier and lower the hooks under the attachment tool hookup bar.



4. Tilt the tool carrier back so that the lock plate engages the attachment tool. This secures the attachment tool to the Quick-attach™ System.



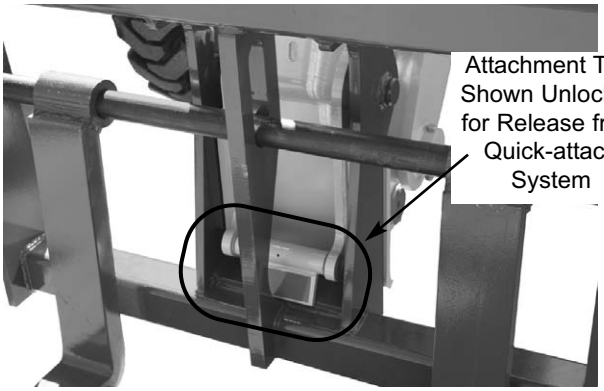
Quick-attach System Attaching Detail

5. For an attachment tool with auxiliary hydraulics, connect the hoses to the quick-disconnect connectors on the boom nose.

Detaching

To detach the attachment tool, proceed as follows:

1. Raise the boom slightly and extend it two to three feet (600 to 900 mm) for better visibility. Lower the boom until the attachment tool is approximately 12” (0.3 m) off the ground.
2. Tilt the carrier rearward as far as it will go. Once the carrier is tilted back all the way, perform the Mandatory Safety Shutdown Procedure (*Safety* chapter, page 8).
3. With the engine off, leave the operator’s station and manually raise the lock spring and flip the lock plate up and outward at least 180° so it is in position to re-lock onto the next attachment tool.



Quick-attach System Detaching Detail

4. Tilt the Quick-attach™ System forward to allow the attachment tool to roll out, then lower the boom so that the hook ears clear the hookup bar on the attachment tool.

NOTE: *One side of the lock plate has a bright red decal to indicate the unlocked position.*

5. If the attachment tool has auxiliary hydraulics, disconnect the hoses from the quick-disconnects on the boom nose.
6. Start the engine and roll the Quick-attach™ System forward. Slowly back the machine until the attachment tool is free from the boom nose.

⚠ WARNING

Modifications, alterations to, or use of attachment tools not authorized by Manitou Americas (or the manufacturer) in writing can void warranty and cause machine damage and/or serious personal injury or death.

SELF-LEVELING

The machine is equipped with a hydraulic self-leveling feature. This feature is designed to keep the attachment tool level while the boom is being raised.

GENERAL MACHINE OPERATION

Check the Telescopic Handler to be sure all systems are in good operating condition. Perform the following steps before starting the machine the first time each day:

1. Check the engine oil, coolant, transmission oil and hydraulic oil levels.
2. Make sure weekly lubrication has been done.
3. Visually inspect for leaks, broken or malfunctioning parts. Make sure all caps, covers and safety shields are in place.
4. Check tires for cuts, bulges, nails, correct pressure, loose wheel nuts, etc.
5. Inspect the work area. Be sure you know where you will make load pickups, placements, lifts, and turns. Look over the terrain of the jobsite for holes, obstacles, slippery surfaces, and soft or deep mud.
6. Check clearances of ramps, doorways and passageways. Check overhead clearances if you will travel and place loads near power or telephone lines.

If the machine is found to be in need of repair or in any way unsafe, or contributes to an unsafe condition, the matter must be reported immediately to the user’s designated authority. The machine should not be operated until it has been restored to a safe operating condition.

⚠ WARNING

Exhaust fumes can kill. Ensure proper ventilation when starting indoors or in enclosed areas.

Use proper hand-holds, NOT the steering wheel or control levers as handholds when mounting and dismounting.

NEVER operate the machine with safety guards or covers removed.

Over-inflated tires can explode and cause injury or death. Tire repairs MUST be made only by authorized personnel using proper tools and equipment.

Operate the travel controls gradually and smoothly when starting, stopping, turning and reversing direction.

Grade and Slope Precautions

The Telescopic Handler complies with industry stability test requirements and is stable when properly operated. However, improper operation, faulty maintenance, and poor housekeeping can contribute to a condition of instability.

The amount of forward and rearward tilt to be used is governed by the application. Although use of maximum rearward tilt is allowable under certain conditions, such as traveling with the load fully lowered, the stability of the machine, as determined by the industry standard tests, does not encompass consideration for excessive tilt at high elevations, or the handling of off-center loads.

Only handle loads within the capacity limits of the machine, and which are stable and safely arranged. When attachments are used, extra care should be taken in securing, manipulating, positioning and transporting the load.

Grade Limits

NOTE: *Grade limits are based on ANSI/ITSDF standard B56.6-2005.*

The telescopic handler meets or exceeds the safety standard (ANSI/ITSDF B56.6) stability limits for rough terrain forklifts. The stability tipping limits cover specific, controlled test conditions, which are extremes, and which are not intended to be achieved during normal worksite operations. The following specifications are provided only as information to the operator, and must not be used as a guideline for operating the telescopic handler. For safe operation, always follow the instructions and warnings provided in this manual.

⚠ WARNING

DO NOT level the frame with the boom raised or extended. Only level the frame while stopped, and with the boom fully retracted, and the attachment tool raised just enough to clear the ground.

1. DO NOT place or retrieve loads on an up or down slope or grade that exceeds 7% or 4°.
2. DO NOT travel up or down a grade or slope that exceeds 22% or 12° while loaded.
3. DO NOT place or retrieve loads on a side hill with a slope or grade that exceeds 12% or 7°. Regardless of the terrain or position of the wheels, the **FRAME MUST BE LEVEL**, as indicated by the frame angle indicator on the ROPS/FOPS crossmember.
4. DO NOT travel across a side hill that exceeds 18% or 10° grade. Regardless of the terrain or position of the wheels, the **FRAME MUST BE LEVEL,** as indicated by the frame angle indicator on the ROPS/FOPS crossmember. The attachment tool MUST be maintained at the “carry” position with the boom fully retracted, and attachment tool at minimum ground clearance.

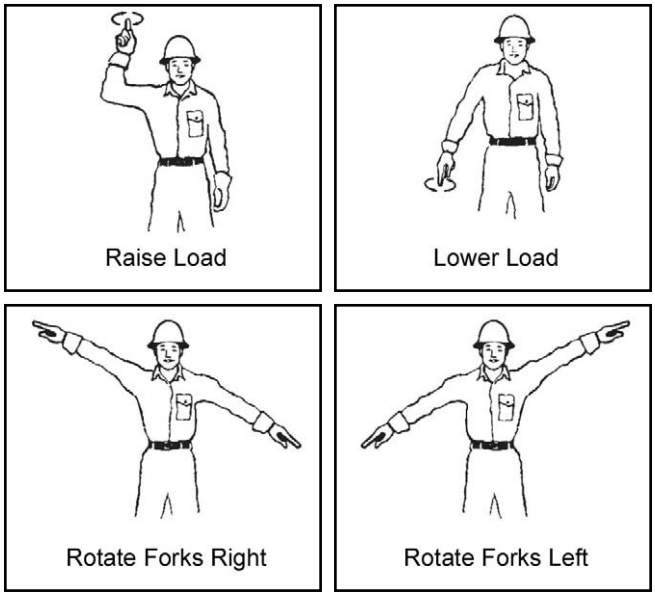
When ascending or descending grades in excess of 5% or 3°, the machine should be driven with the load upgrade. An unloaded machine should be operated on all forward grades with the load handling attachment tool downgrade, tilted back if applicable, and raised only as far as necessary to clear the road surface.

On grades, ramps and inclines, use extreme caution and avoid turning if possible. Normally travel straight up and down the slope.

Traffic Flow Patterns

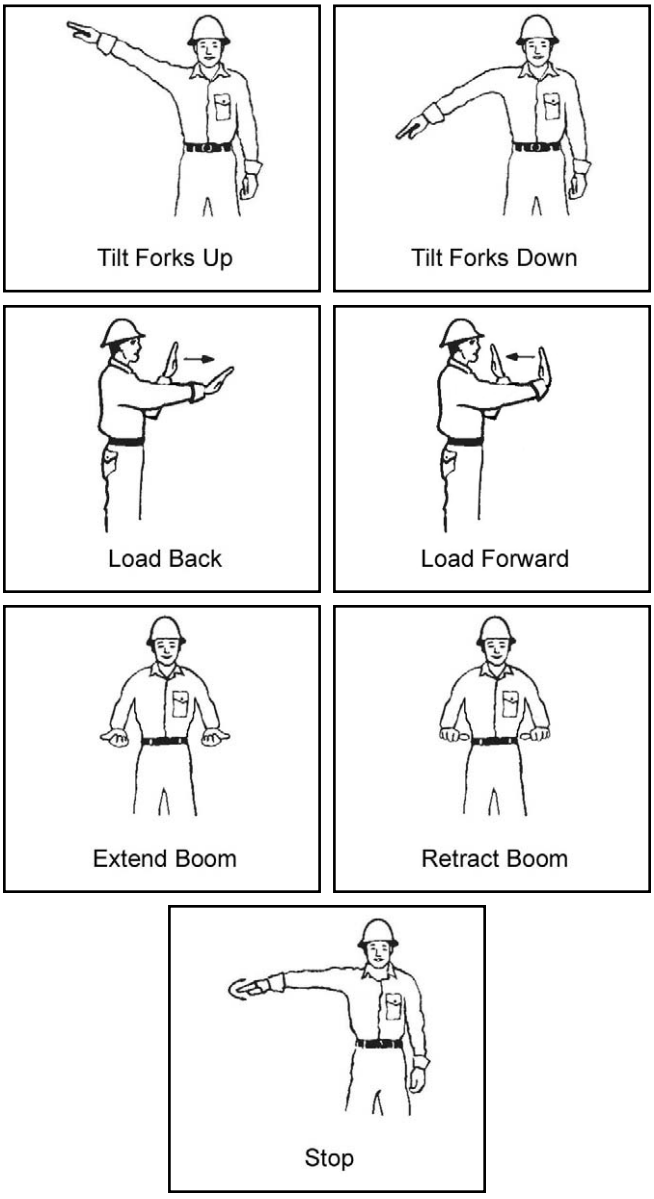
Know and understand the traffic flow patterns of your jobsite. Know all Telescopic Handler hand signals for safety. Utilize signal persons and be sure you can see the signal person and acknowledge the signals given.

Safety Hand Signals



Safety Hand Signals Continued on Next Page

Safety Hand Signals Continued



When ramps must be used in transporting loads with the machine, the following shall be the minimum widths for safe travel:

Compacted dirt, gravel, etc.	12 ft. (3.6 m)
Woodboard, concrete, etc.	10 ft. (3.0 m)

Permanent aisles, roadways, passageways, floors and ramps should be marked or defined in some fashion. Permanent or temporary protrusion of loads, equipment, material and construction facilities into the usual operating area should be guarded, clearly and distinctively marked, or clearly visible.

Maintain a safe distance from the edge of ramps, platforms and other similar working surfaces.

Controlled lighting of adequate intensity should be provided in operating areas. Where operating conditions dictate, the operator/user is responsible for having the machine equipped with lights.

Provisions should be made to prevent trucks, semitrailers and railroad cars from being moved during loading and unloading. Wheel stops, parking brakes, or other positive holding means should be used to prevent movement during loading and unloading.

DO NOT move railroad cars and trailers with the Telescopic Handler.

DO NOT use the boom and attachment for leverage to push the machine out of mud.

IMPORTANT: *DO NOT lower boom at high engine speed when attachment tool is at maximum rearward tilt. Damage to slave cylinders may result.*

GENERAL LOAD HANDLING

NEVER operate controls except from the operator's seat. NEVER jerk or use fast movements. Avoid sudden stops, starts and changes in direction.

Operation of the hydraulic system depends on engine speed and the distance the controls are moved. When operating these controls it is important to develop a technique called "feathering." Feathering the control means starting the desired motion by moving the control a small distance away from neutral. Then, after movement has started, the control can be eased to full travel. Use the same feathering technique to slow and stop the motion.

⚠ WARNING

Excessive speed can be hazardous. ALWAYS exercise caution and good judgement while operating the machine.

ALWAYS maintain a safe distance from electric power lines and avoid contact with any electrically charged conductor and gas line. It is not necessary to make direct contact with a power line for power to ground through the structure of the machine. Keep the boom and load at least 10 ft. (3 m) from all power lines. Accidental contact with a power line or rupture of a gas line can result in electrocution or an explosion. Contact the "Call Before You Dig" referral system number at 8-1-1 in the U.S., or 888-258-0808 in the U.S. and Canada,

to locate any underground utility lines BEFORE starting to dig.

Keep all body parts inside the operator's station while operating the machine. BE SURE of clearance for the attachment tool when turning, working around buildings, etc.

Turning corners too fast can tip the machine, or cause a load to slide off the attachment. Sudden slowing or stopping of the machine may cause the load to fall off the attachment tool.

Be certain you can control both speed and direction before moving. Always place the machine in neutral and set the parking brake before raising or extending the boom. NEVER drive the machine up to someone standing in front of the load.

NEVER leave the operator's station without first lowering the attachment tool to the ground. Then set the parking brake, place controls in neutral, shut off engine and remove the key. AVOID parking the machine on a slope, but if necessary, park across the slope and block the tires.

Load Capacity and Reach

The machine has flip-charts in the operator's station that provide, at a glance, the load capacity limits at various positions of attachment tool extension and elevation. A set of the load zone charts is reproduced at the end of this manual for reference.

A typical load zone chart is shown on the next page. The scale on the left indicates height in feet above the ground level. The scale on the bottom shows the distance in feet from the front of the machine. The arc lines noted by the numbers "1" through "5" correspond with the position extension markers on the operator side of the intermediate boom section.

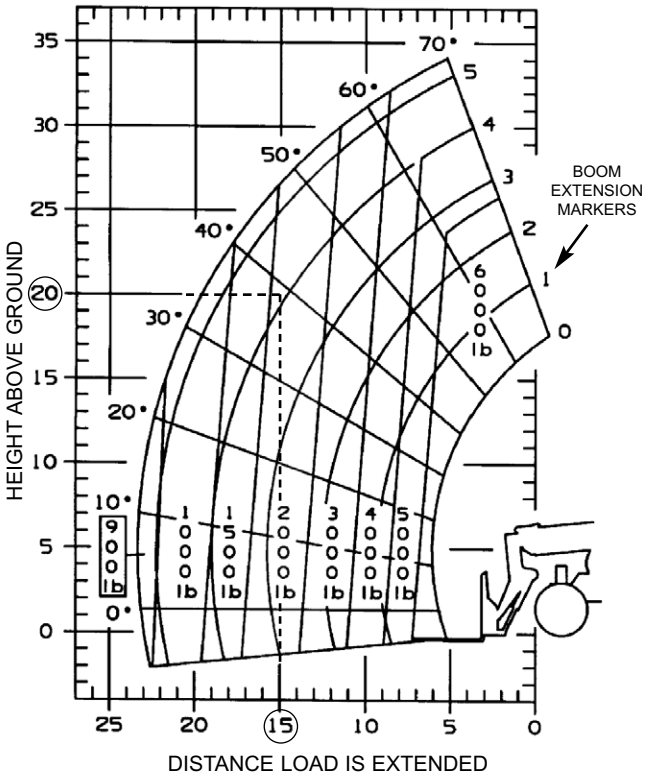
The following example illustrates proper use of the load zone charts for the Telescopic Handler:

Example: The operator, using a standard carriage attachment tool, wants to raise a 2000 lb. load 20 feet high, and can only get to within 15 feet of the load placement point. Can it be done within the capacity of the machine?

Analysis: See "Typical Load Zone Chart" below.

Projecting up from the 15-foot reach mark on the horizontal axis to intersect a line through the 20-foot height mark on the vertical axis shows that a load up to 2000 lb. can be placed in that zone.

During placement, the operator should observe when the boom extension mark number "4" on the boom is visible and stop further extension. The operator knows the maximum safe extension distance with the 2000 lb. load has been reached.



Typical Load Zone Chart

⚠ WARNING

NEVER exceed the rated operating capacity of the Telescopic Handler as shown on the load zone charts.

HANDLING NON-SUSPENDED LOADS

Picking Up the Load

Inspect the load before picking it up. If it appears unstable, DO NOT attempt to move it. DO NOT attempt lifting double-tiered loads, or straddling side-by-side pallets with one on each fork. NEVER add extra unauthorized counterweights to the machine.

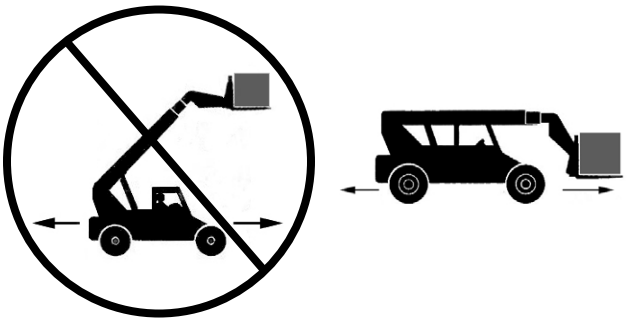
Approach the load slowly and squarely with the machine straight and level. Adjust the space between forks, if necessary. Engage the load equally on the forks until the load touches the carriage backrest. Tilt the forks back to position the load for travel.

WARNING

Operating conditions such as slopes or soft ground can reduce the machine's safe operating capacity. Exceeding the capacity when raising or extending the boom will cause the machine to tip forward.

Carrying the Load

If the load obstructs your view, get someone to direct you. Maintain ground speeds consistent with ground conditions and that permit stopping in a safe manner.



WARNING

NEVER travel with the boom above the carry position (attachment tool should be at minimum ground clearance). Boom should be fully retracted.

Use lower gear when traveling down an incline. NEVER coast with the transmission in neutral. Travel up and down grades slowly.

DO NOT operate the machine on a slope or grade that exceeds 22% or 12º.

Load Elevation and Placement

For ground level load placement, be sure the area under the load and around the machine is clear of equipment and personnel. Lower the load to the ground, tilt the forks to the horizontal position, and then carefully back away to disengage the forks from the load.

For elevated or overhead placement, bring the machine as close as possible to the landing point, and then:

1. Level the machine BEFORE raising the load. Use extreme caution for high placement. Be sure personnel are clear of the area where the load or the machine could fall or tip.
2. Set the parking brake, hold the service brake pedal fully applied and slowly raise the load, maintaining a slight rearward tilt to cradle the load.
3. As the load approaches the desired height, feather the boom control at minimum speed until the load is slightly higher than the landing point.
4. Continuing the feathering technique, lower the load into place.
5. Free the forks from the load by alternately retracting and raising the boom. If this process is not possible, very slowly and carefully reverse the telescopic handler to free the forks from the load.
6. Lower the forks to travel height.

WARNING

The machine becomes less stable as the load is raised higher.

NEVER use frame leveling to position an elevated load. Always lower the load to the ground and reposition the machine.

If a hydraulic boom circuit hose should break with the boom up, shut down the machine. DO NOT attempt to bring down the boom or make repairs. Call your Manitou Americas dealer immediately.

As lift height increases, depth perception decreases. High elevation placement may require a signal person to guide the operator.

DO NOT ram the lift cylinders to the end of the stroke. The resulting jolt could spill the load.

A jib or truss boom should ONLY be used to lift and place loads when the machine is stationary and the frame is level. Transporting suspended loads must ALWAYS be done slowly and cautiously, with the boom and load as low as possible. Use taglines to restrict loads from swinging, to avoid overturn.

HANDLING SUSPENDED LOADS

Determine the weight and load center of the load to be handled. Refer to the telehandler load chart to determine if the load can safely be handled.

NOTE: *Refer to the standard carriage load chart when using the boom mounted hook.*

WARNING

NEVER exceed the rated operating capacity of the telehandler as shown on the load zone charts.

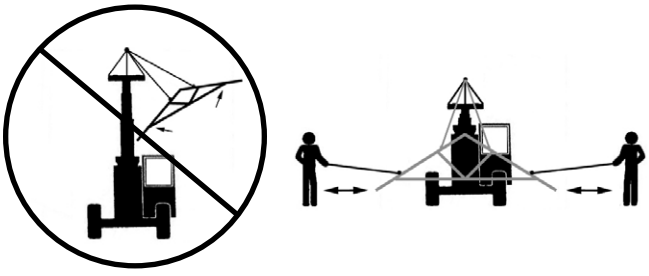
WARNING

Operating conditions can reduce the telehandler's safe operating capacity. Exceeding the capacity when raising or extending the boom will cause the telehandler to tip forward.

Picking Up Suspended Load

1. Rigging should be in good condition and rated for the load being lifted.
2. Rigging should comply with OSHA regulation §1910.184, "Slings," or §1926.251, "Rigging equipment for material handling."
3. Be sure the rigging equipment is clear of any part of the machine or machine attachment before lifting the load.
4. Avoid lifting double-tiered or any unstable loads.
5. Only lift loads vertically and clear from any adjacent obstacles. Never drag the load horizontally.
6. Use multiple lift points and taglines to restrain the load from swinging or rotating.

Carrying Suspended Load



1. Rigging between the load and attachment should be as short as possible to reduce boom height.
2. Do not raise the load more than 12 inches (305 mm) above the ground or raise the boom more than 45 degrees.
3. All telehandler movements should be performed slowly and cautiously to prevent load swing. Avoid abrupt movement. Do not exceed walking speed.
4. Use a signal person anytime the load restricts the operators view or assistance is required. The signal person should remain in contact (verbally or visually) with the operator at all times until the load is placed.

Ground Level Suspended Load Placement

1. Be sure the area under the load and around the telehandler is clear of equipment and personnel.
2. Lower the load to the ground till load is stationary and the rigging is loose from the load. Have signal person disconnect the rigging from the load.
3. Raise boom enough to clear the rigging from the load before backing the telehandler away from the load.

Elevated Suspended Load Placement

1. Bring the telehandler as close as possible to the landing point.
2. Level the telehandler BEFORE raising the load. Use extreme caution for high placement. Be sure personnel are clear of the load landing area.
3. Set the parking brake, shift the transmission into neutral, hold the service brake pedal fully applied and slowly raise the load.
4. As the load approaches the landing point, feather the boom control at minimum speed until the load is just above the landing point.
5. With the assistance of a signal person, continue the feathering technique to lower the load into place.

WARNING

NEVER place the signal person between the load and the telehandler or other stationary objects.

6. Once the load is stationary on the landing point and the rigging is loose from the load, have the signal person disconnect the rigging from the load.
7. Raise boom enough to clear the rigging from the load. Slowly and carefully, reverse the telehandler till the rigging is clear of the load.
8. Lower the boom to travel height.

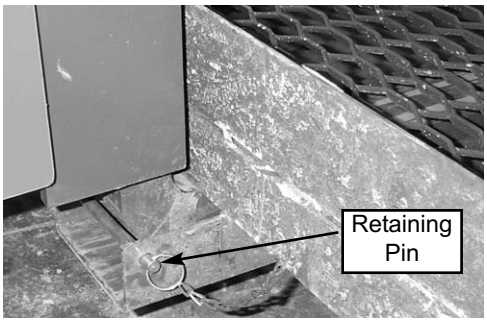
Installing a Personnel Work Platform (PWP)

WARNING

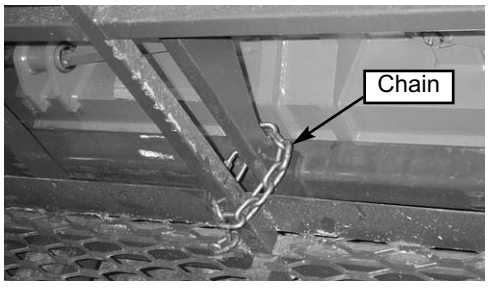
The machine must not be used to lift or carry personnel or be fitted with any form of personnel work platform unless fitted with the optional PWP System.

If fitted with the PWP System, the Mandatory Work Platform Safety Rules (p. 14) must be followed at all times while lifting personnel.

1. Center the forks on the carriage, spaced apart to match the distance required to engage the PWP.
2. After the forks are fully engaged in the PWP, secure the PWP to the forks. This can be accomplished by means of a retaining pin behind the heel of the forks, as shown.



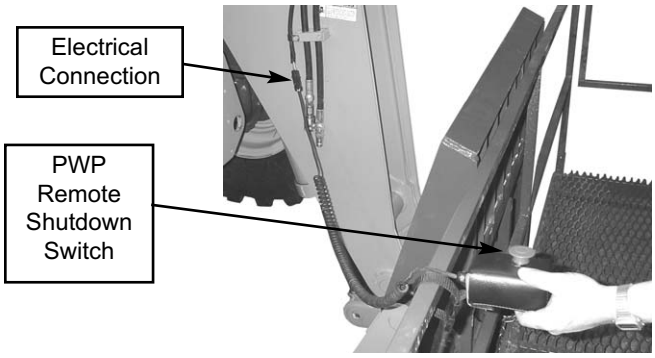
3. Secure the forks from pivoting upward in case the PWP is lowered onto an obstruction. This can be accomplished by using the chain supplied with the PWP to secure the lower portion of the PWP to the bottom of the carriage, as shown below.



WARNING

The PWP must meet ANSI/ITSDF B56.6-2005, Section 8.24. (See page 15 in the *Safety* chapter for PWP design requirements.) If the PWP being used does not offer means to secure the PWP to the forks and to secure the forks from pivoting, as shown in steps 2 and 3, then an alternate method must be used.

4. Connect the coiled wire from the remote shutdown switch to the connector on the end of the boom. Secure the remote shutdown switch to the PWP using the strap attached to the switch, as shown below.



Remote Shutdown Switch

5. Secure the lanyard from the body harness to the PWP or the boom. Each person in the PWP should have a body harness with a lanyard attached to the PWP.

Elevating Personnel

The Telescopic Handler is primarily intended for use as a material handler. It should only be used to elevate personnel if it is equipped with the (optional) PWP System when there is no other practical option. If this machine is to be used to elevate personnel, then use only an approved work platform, lift personnel only with the PWP System activated, and follow the “Mandatory Work Platform Safety Rules” (p. 14 Safety chapter).

If the Telescopic Handler is equipped with a PWP System and is to be used for elevating personnel, the system must be activated, by the "PWP System" mode switch, which is located in the instrument and switch panel. To activate the system, press the top of the PWP rocker switch, apply and hold the service brakes on for three or more seconds. The system is activated when the lamp in the PWP rocker switch is on continuously.

NOTE: *If the light is flashing, apply the service brakes until the light stops flashing.*

WARNING

ALWAYS check the PWP System for proper operation prior to use. (See page 53 for PWP System checking procedure.)

When the PWP System is active:

- transmission is de-clutched into Neutral,
- parking brake is applied,
- auxiliary hydraulic and carriage tilt and swing functions are disabled,
- machine inclination sensor is activated, with the result that the Telescopic Handler must be level laterally (side-to-side) and longitudinally (front-to-back) to within the factory pre-set limits before the boom control joystick will function, and
- remote shutdown switch is activated, meaning that the switch must be connected and in the "on" position for the boom control joystick to function. Pressing the shutdown switch will disengage the boom control joystick, and stop all platform movement. The remote shutdown switch box is supplied with a coiled electrical cable that must be connected to the outlet on the front of the innermost boom section near the carriage. The switch must be accessible by the platform personnel at all times when the platform is to be moved.

To de-activate the PWP System, apply and hold the service brakes on for three or more seconds, and press the bottom of the PWP System rocker switch. The system is de-activated when the lamp in the PWP System rocker switch is off.

NOTE: *If the lamp in the PWP system rocker switch is flashing, apply the service brakes until the lamp goes off.*

WARNING

In an emergency, if the platform worker has activated the remote shut-off switch and then is not able to re-activate the switch, such as if the worker fainted, then the Telescopic Handler operator is permitted to turn off the PWP System to regain control of the boom functions, in order to lower the work platform and come to the aid of the worker. But, understand this is only permitted in case of an emergency. Otherwise, the PWP System must be used at all times when there are workers on the platform. This is the only exception!

ROAD TRAVEL

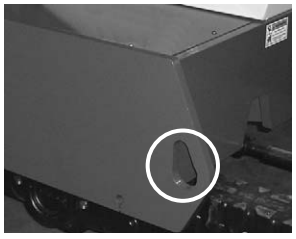
For short distance highway travel, attach a Slow-Moving Vehicle (SMV) emblem (purchased locally) to the rear of the Telescopic Handler. For highway operation, obtain and install an amber flashing beacon.

NOTE: *ALWAYS follow ALL state and local regulations regarding the operation of equipment on or across public highways. Whenever there is an appreciable distance between jobsites, or if driving on public highway is prohibited, transport the machine using a vehicle of appropriate size and capacity.*

TRANSPORTING BETWEEN JOB-SITES

ALWAYS abide by the following recommended procedures and guidelines when using ramps to load the machine onto (and unload it from) a truck or trailer. Failure to heed can result in damage to equipment and serious personal injury or death!

Tie-down eyes are provided for inserting chains through to secure the machine during transporting.

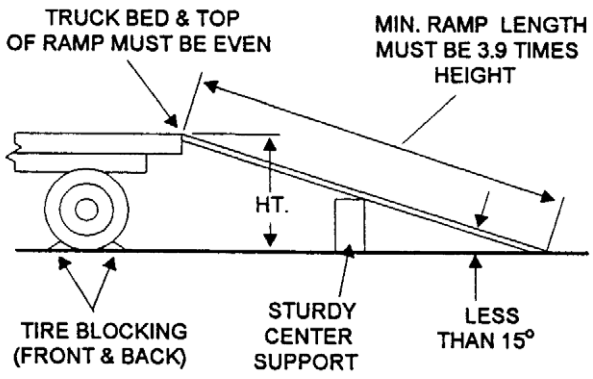


Front Tie-Down

Rear Tie-Down

Loading Machine Using Ramps

NOTE: *A matched pair of ramps is required.*


TRUCK BED & TOP OF RAMP MUST BE EVEN
MIN. RAMP LENGTH MUST BE 3.9 TIMES HEIGHT
HT.
TIRE BLOCKING (FRONT & BACK)
STURDY CENTER SUPPORT
LESS THAN 15°

Ramp Placement

1. The ramps MUST be of sufficient strength to support the machine. The use of strong steel ramps is recommended, as well as center supporting blocks.
2. The ramps MUST be firmly attached to the truck or trailer bed with NO step between the bed and the ramps.
3. The incline of the ramps MUST be less than 15 degrees. For a four-foot high truck bed, ramp length must be at least 16 feet (4.9 m) long.
4. Ramp width MUST be at least 1-1/2 times the tire width.
5. Block the front and rear of the tires on the truck or trailer. Engage the parking brake.
6. Position the machine with the boom facing toward the front of the truck or trailer so that it is straight in line with the ramps.
7. Slowly (at the lowest engine speed possible) and carefully drive the machine up the ramps.
8. Secure the machine to the bed of the truck or trailer with tie-down chains/cables.

Unloading Machine Using Ramps

NOTE: *A matched pair of ramps is required.*

Repeat steps 1 through 5 and proceed as follows to unload the machine:

6. Remove the tie-down chains/cables.
7. If necessary, adjust the machine so that the wheels are in line and centered with the ramps.
8. Slowly (at the lowest engine speed possible) and carefully drive the machine down the ramps.

⚠ WARNING

NEVER adjust travel direction (even slightly) while traveling on the ramps. Instead, back down off the ramps, and then realign the machine with the ramps.

⚠ WARNING

NEVER transport the machine with the boom raised or extended. BE SURE to secure the machine to the truck or trailer bed using chain and binders or steel cables, to prevent any movement while transporting.

THEFT DETERRENTS

Manitou Americas has recorded all major component part numbers and serial numbers. Users should take as many of the following actions as possible to discourage theft, to aid in the recovery of the machine in the event it is stolen, and to reduce vandalism:

1. Remove keys from unattended machines.
2. Attach, secure, and lock all anti-vandalism and anti-theft devices on the machine.
3. Lock doors of cabs when not in use.
4. Inspect the gates and fences of the equipment storage yard. If possible, keep machines in well-lighted areas. Ask the local law enforcement agency to make frequent checks around the storage and work sites, especially at night, during weekends, and on holidays.
5. Report any theft to your dealer and insurance company. Provide the model and serial numbers. Request your dealer to forward this information to Manitou Americas.

Chapter 7

LUBRICATION

GENERAL INFORMATION

WARNING

NEVER lubricate or service this unit when any part of the machine is in motion. ALWAYS exercise the MANDATORY SAFETY SHUT-DOWN PROCEDURE (p. 8, *SAFETY* chapter) before lubricating or servicing this equipment.

NOTE: *The Maintenance chapter (Chapter 10) in this manual has provisions for recording the dates and hourmeter readings after lubrication or other service has been performed; use those spaces to keep a log for maintaining a current service interval record. Proper routine lubrication is an important factor in preventing excessive part wear and early failure.*

LUBRICANTS

The chart on this page lists the locations, temperature ranges and recommended types of lubricants to be used when servicing the machine. Refer to the separate engine manual for additional information regarding recommended engine lubricants, quantities and grades required.

NOTE: *Refer to Operator Services topic in the Service and Storage chapter of this manual for detailed information regarding periodic checking and replenishing of lubricants.*

Transmission Oil

Temp. Range -25°F - 75°F (-32°C - 24°C)
Use Dexron® II or equivalent
Factory filled with CHS Cenex Auto Gold D/M

Temp. Range 0°F - 100°F (-18°C - 38°C)
Use Allison C-4 30W or equivalent
Capacity: 24 quarts (23 liters)

Brake System

Use Multi-ATF Dexron® II/III or equivalent

Hydraulic System Reservoir

Use an oil that contains anti-rust, anti-foam and anti-oxidation additives and conforms to ISO VG46/VG32.
Factory filled with CHS Cenex Indol
Alternative oil: Mobil DTE 15M or equivalent
Capacity: 35 gallons (133 liters)

Engine Crankcase Oil

Ambient Temperature		Grade*
-22°F - 86°F	(-30°C - 30°C)	SAE 5W-30
-22°F - 104°F	(-30°C - 40°C)	SAE 5W-40
-4°F - 86°F	(-20°C - 30°C)	SAE 10W-30
-4°F - 104°F	(-20°C - 40°C)	SAE 10W-40
5°F - 104°F	(-15°C - 40°C)	SAE 15W-40

IMPORTANT: Refer to the Engine Operator's Manual for specific oil recommendations and additional information.

***API Service Classification: CJ-4**

Capacity: 9.5 quarts (8.9 liters)

Diesel Fuel

Use only ultra low sulfer (ULSD) diesel fuel with a maximum of 15 PPM sulfer content specified to EN590 or ASTM D975.

Engine Coolant

IMPORTANT: Use an ethylene glycol based Extended Life Coolant and quality water mixture suitable for heavy duty diesel engines. Coolant should be a phosphate-free, silicate-free, nitrite-free and borate-free formula with corrosion inhibitors to provide wet sleeve liner cavitation and corrosion protection of all cooling system metals.
Factory filled with: FINAL CHARGE 50/50 PRE-DILUTED Global Extended Life Coolant/Antifreeze.

Axle Gear Oil

Factory filled with CHS Cenex Qwiklift HTB
Alternative oil: MobilFluid® 424 or equivalent
Differential capacity: 9.6 quarts (9.0 liters)
Planetary capacity: 0.6 quarts each (0.5 liters)

All Grease Fittings

Use No. 2 lithium-based grease

REPLACEMENT FILTER CHART

ENGINE TYPE	AIR FILTER	FUEL	ENGINE OIL	HYDRAULIC FILTER	HYDRAULIC STRAINER	TRANS. OIL
Deutz TD3.6 L4	Primary 50352454	Filter 50302441	132023	L97489	L49327	L99184
	Safety 50352455	Separator Filter 50303847				

GREASING

Refer to the illustrations and listings for fitting locations. Wipe dirt from the fittings before greasing them to prevent contamination. Replace any missing or damaged fittings. To minimize dirt build-up, avoid excessive greasing.

BASIC MACHINE GREASE FITTINGS LOCATIONS

Every 50 Hours (or weekly)

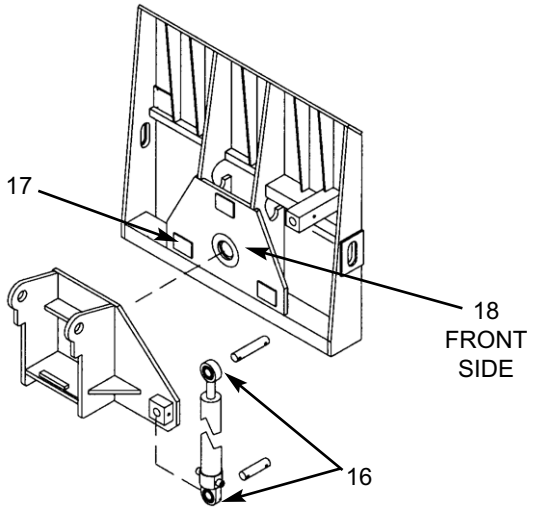
Refer to the illustration on the facing page for locations.

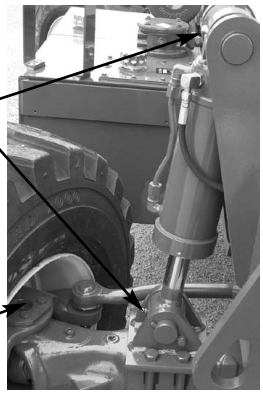
CHASSIS AREA

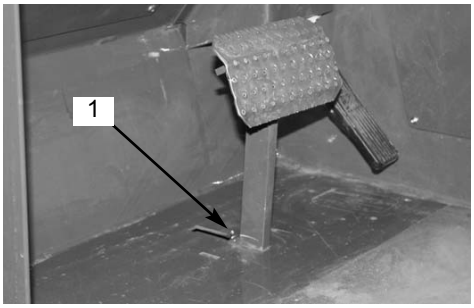
1 Brake foot pedal linkage 1
2 Wheel spindle pins (per axle) 4
3 Axle-to-frame pivot pins (per axle) 2
4 Drive shaft, slip joint (per shaft) 1
5 Drive shaft, u-joint (per shaft) 2
6 Level cylinder pivot pins 2
7 Base end, lift cylinder pivot pins 2
8 Base end, slave cylinder pivot pins 2

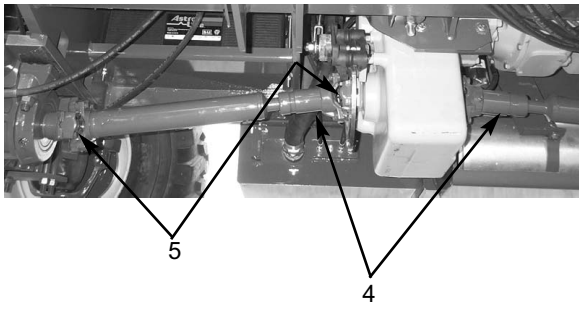
BOOM AREA

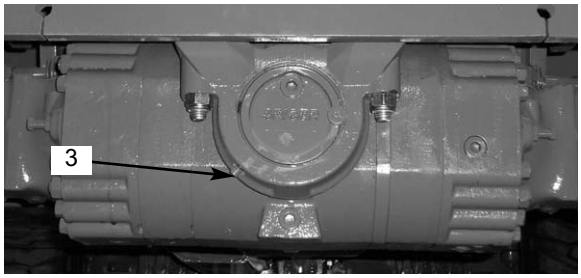
9 Boom-to-frame-upright pivot pins 2
10 Rod end, slave cylinder pivot pins 2
11 Rod end, lift cylinder pins 2
12 Extend cylinder pivot pins 2
13 Chain sheave pins 2
14 Quickattach-to-boom-nose pivot pins 2
15 Tilt cylinder pivot pins 2
16 Rotate cylinder pivot pins 2
17 Rotate carriage wear pads 3
18 Rotate pivot bearing 1
19 Boom slide pads - as required, front and rear

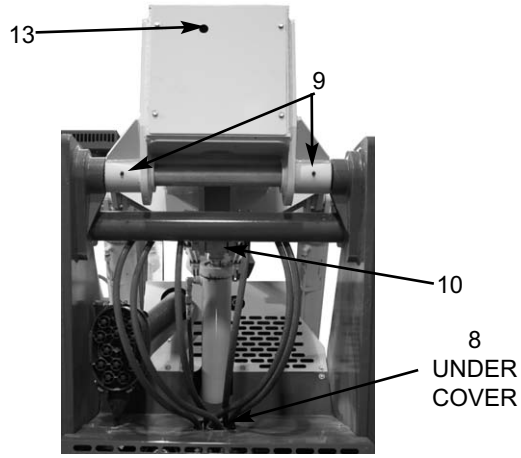


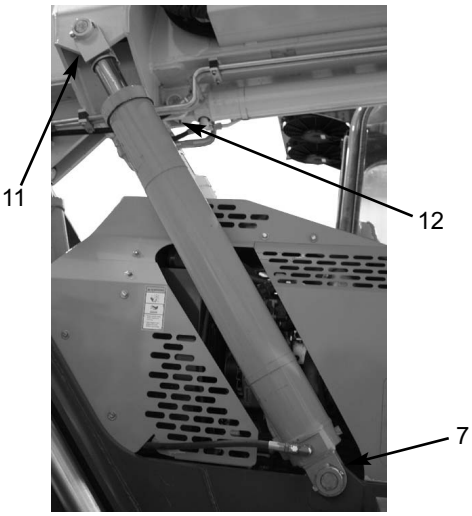


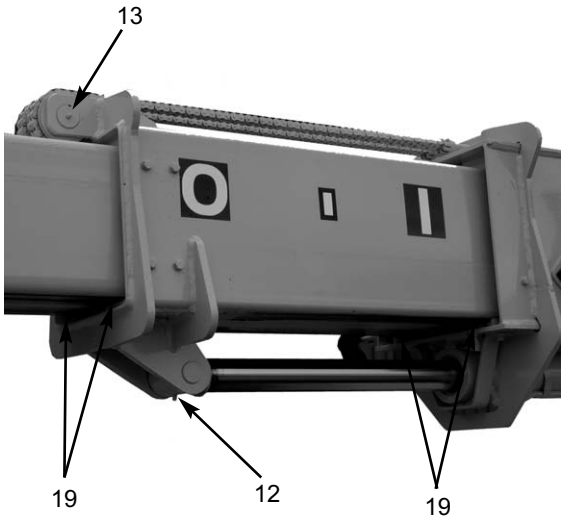












Grease Fittings Locations

Chapter 8

SERVICE AND STORAGE

GENERAL INFORMATION

WARNING

BEFORE performing any service on the Telescopic Handler, unless expressly instructed to the contrary, exercise the MANDATORY SAFETY SHUTDOWN PROCEDURE (p. 8, Safety chapter). After service has been performed, BE SURE to restore all guards, shields and covers to their original positions BEFORE resuming machine operation.

NOTE: *All service routines, with the exception of those described under the "Dealer Services" topic, are owner-operator responsibilities. All operator services described under the subtopics are also referred to on a decal located on the inside right side panel of the operator's station. Refer to the Lubrication chapter of this manual for lubrication information.*

NOTE: *This Service and Storage chapter details procedures to follow for making routine maintenance checks, adjustments and replacements. The majority of the procedures are also referred to in the Maintenance chapter of this manual. For engine-related adjustments and servicing procedures, refer to the engine manual provided.*

PRECAUTIONS

DO NOT perform any maintenance or repair without the owner's prior authorization. Allow only trained personnel to service the machine.

Warranty repairs can only be done by a Manitou Americas dealer. Dealers know what portions of the machine are covered under the terms of the Manitou Americas Warranty and what portions are covered by other vendor warranties.

When a problem occurs, do not overlook simple causes such as an empty fuel tank. Check for leaks and broken connections. Make note of any specific symptoms, noises, etc. and contact your local Manitou Americas dealer.

IMPORTANT: *Always dispose of waste lubricating oils, anti-freeze and hydraulic fluids according to local regulations or take them to a recycling center for disposal. DO NOT pour them onto the ground or into a drain.*

DEALER SERVICES

The following areas of internal components service replacement and operating adjustments should only be performed by (or under the direction of) an authorized Manitou Americas Telescopic Handler dealer.

IMPORTANT: *DO NOT service or repair major components, unless authorized to do so by your Manitou Americas dealer. Any unauthorized repair will void the warranty.*

POWERTRAIN COMPONENTS

The engine and transmission are coupled directly to each other. All service routines related to the internal components are precise and critical to proper powertrain operation. The axle differential and planetary ends are also sophisticated assemblies that require special know-how and tools for servicing.

IMPORTANT: *If any powertrain components are suspected of faulty operation, contact your Manitou Americas dealer for assistance.*

HYDRAULIC SYSTEM COMPONENTS

Valves, pumps, motors and cylinders are sophisticated assemblies, which require special know-how and tools for servicing. All cylinders are appropriately designed with particular strokes, diameters, checks and hose connection provisions unique to the machine application requirements. A hydraulic schematic (located at the back of this manual) can be used as a guide for service reference, as required.

⚠ WARNING

Tilt, lift, extend and leveling cylinders have counterbalance valves. These valves keep hydraulic fluid from entering and exiting the cylinders while not being used, and are under extremely high pressure. Before removing any of these valves, it is REQUIRED to call the your Manitou Americas Service Department. Failure to do so may result in serious injury or death.

Internal service on any of these components should only be performed by (or under the direction of) an authorized Manitou Americas Telescopic Handler dealer.

ELECTRICAL COMPONENTS

An electrical system schematic is provided, which includes instrumentation, electrical components and switch connections. It is located at the back of this manual and can be used as a guide for service reference, as required.

OPERATOR SERVICES

Some of the operator-related services will require access to components located inside the superstructure, under shields, hoods and covers. The chart on this page notes the components accessed in each particular area.

ACCESS TO COMPONENTS CHART

Component	Operator's Station	Frame	Front Cover	Mid-Rear Hood
Axle (underside)		●		
Engine				●
Transmission (center area)			●	
Drive Shafts (underside)		●		
Main Control Valve (rear)		●		
Muffler (underside)		●		
Air Cleaner (between boom supports)		●		
Battery		●		
Radiator				●
Brake Valve (underside)	●			
Travel Controls (dash area)	●			
Boom Controls (right side)	●			
Hydraulic Test Ports			●	
Hourmeter (dash)	●			
Switches/Indicators (dash)	●			
Hydraulic Pump			●	
Hydraulic Filter (Reservoir)		●		
Misc. Hydraulic Valves			●	
Heater (lower front)	●			

WARNING

DO NOT smoke or allow any open flames in the area while checking or servicing hydraulic, battery or fuel systems; all contain highly flammable liquids or explosive gases, which can cause an explosion or fire if ignited.

Wear a face shield when disassembling spring-loaded components or working with battery acid. Wear a helmet or goggles with special lenses when welding or cutting with a torch.

When working beneath a raised machine, always use blocks, jack-stands or other rigid and stable supports. Wear appropriate protective clothing, gloves, and shoes. Keep feet, clothing, hands and hair away from moving parts.

Always wear safety glasses or goggles for eye protection from electric arcs from shorts, fluids under pressure, and flying debris or loose material when the engine is running or tools are used for grinding or pounding.

NEVER weld on bucket, forks, boom, support frame or ROPS/FOPS without the consent of the manufacturer. These components may be made with metals that require special welding techniques, or with designs that do not allow weld repairs. NEVER cut or weld on fuel lines or tanks.

If repair welding is ever required, BE SURE to attach the ground (-) cable from the welder as close as possible to the area to be repaired. Also, remove positive (+) battery terminal connection before welding.

Choose a clean, level work area. Be sure there is sufficient room, clearances, and adequate ventilation. Clean the walking and working surfaces. Remove oil, grease and water to eliminate slippery areas. Use sand or oil absorbing compound, as necessary, while servicing the Telescopic Handler.

Before starting inspection and repair, move the machine onto a level surface, shut down engine, and release all hydraulic pressure. Always block the boom securely, or lower it to full ground contact. Place all controls in neutral.

Block the tires. Remove the ignition key. Remove only guards or covers that provide needed access. Wipe away excess grease and oil.

Excessively worn or damaged parts can fail and cause injury or death. Replace any cracked or damaged parts. Use only genuine Manitou Americas parts for service.

Use care not to damage machined and polished surfaces. Clean or replace all plates and decals that are damaged or painted over and cannot be read.

WARNING

NEVER leave guards off or access doors open when the machine is unattended. Keep bystanders away if access doors are open.

After servicing, check the work performed, that no parts are left over, etc. Install all guards and covers.

Service Every 10 Hours or Daily

WARNING

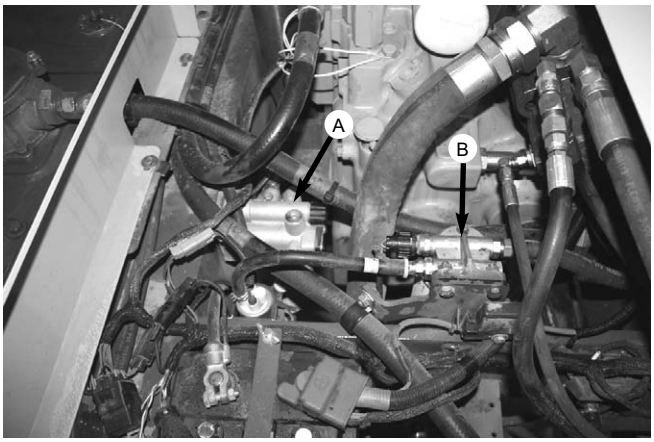
Static electricity can produce dangerous sparks at the fuel-filling nozzle. Do not wear polyester, or polyester-blend clothing while fueling. Before fueling, touch the metal surface of the machine away from the fuel fill to dissipate any built-up static electricity. Do not re-enter the machine but stay near the fuel filling point during refueling to minimize the build-up of static electricity. Do not use cell phones while fueling. Make sure the static line is connected from the machine to the fuel truck before fueling begins.

Ultra-Low Sulfur Diesel (ULSD) poses a greater static ignition hazard than earlier diesel formulations. Avoid death or serious injury from fire or explosion; consult with your fuel or fuel system supplier to ensure the entire fuel delivery system is in compliance with fueling standards for proper grounding and bonding practices.

CHECKING FUEL TANK LEVEL

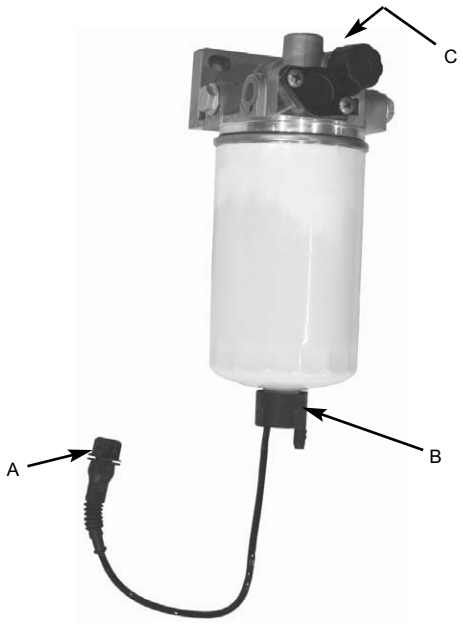
The fuel level is shown by the fuel level gauge in the multi-function display on instrument panel. After operation each day, the fuel tank should be filled to prevent water from condensing in the tank. To fill, remove the filler cap and add fuel. See the *Lubrication* chapter for the diesel fuel requirements.

CHECKING FUEL FILTER



NOTE: *The primary fuel filter/water separator (A) and secondary fuel filter (B) will require occasional replacement to maintain a clean and adequate fuel flow for maximum engine horsepower. The frequency of filter replacement will be determined by the cleanliness of available fuel, the care used in storing fuel supplies, and the operating conditions in which the machine is used.*

Check the primary fuel filter/water separator (A) for water and debris.



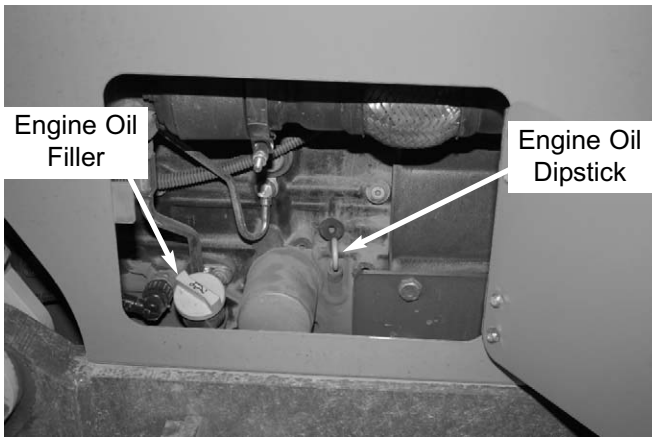
Primary Fuel Filter/Water Separator

IMPORTANT: *Drain water into a suitable container and dispose of properly.*

1. Disconnect the water level sensor electrical connector (A).
2. Loosen vent screw (C) on the top of the filter head several turns.
3. Loosen drain plug (B) until fluid runs out. Let drain until pure diesel fuel flows from the drain.
4. When fuel starts to drain out, tighten drain plug securely.
5. Re-connect the water level sensor electrical connector.
6. Tighten vent screw (C).

A drain plug is also provided in the bottom of the fuel tank for removing condensation and other foreign materials. Open the plug and allow water and fuel to drain into a container until only clear fuel is flowing from the tank.

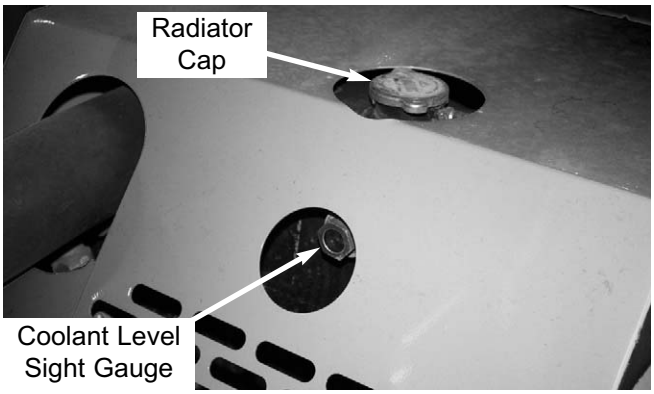
CHECKING ENGINE OIL LEVEL



With the machine on level ground, and the engine stopped for ten minutes or more, remove the engine oil dipstick. Wipe it clean, re-insert it and remove to obtain a reading. If the oil level is below the crosshatch pattern on the dipstick, fill with the required amount of oil to bring the level to within the crosshatch pattern. Oil levels anywhere within the crosshatch are considered full. See the *Lubrication* chapter for the type of oil to use.

IMPORTANT: *Low engine oil level and overfilling engine oil can lead to engine damage.*

CHECKING RADIATOR COOLANT LEVEL



With the machine on level ground, visually check the level of the engine coolant through the sight gauge located on the back of the radiator as shown. Coolant should fill the sight gauge.

WARNING

DO NOT remove the radiator cap when the engine is running hot or overheated. Coolant is extremely hot and under pressure and it can burn your skin. Allow sufficient time for the radiator to cool BEFORE relieving the pressure and removing the radiator cap.

If the coolant level is low, remove the radiator cap and slowly add a low-silicate ethylene glycol based coolant mixed with quality water and supplemental coolant additives (SCAs) suitable for heavy-duty diesel engines untill the sight glass is filled with coolant. See your engine manual for additional information. Replace the radiator cap securely.

NOTE: *Do not fill the radiator to the top of the radiator tank.*

NOTE: *If the engine is operated with a loose radiator cap, the pressure bypass will not work and the engine will run hot.*

CHECKING TRANSMISSION OIL LEVEL

The machine must be on level ground. With the engine and transmission at operating temperature, parking brake on, transmission in neutral and engine speed at low idle, remove the access cover to the transmission and hydraulic pump. Remove the dipstick and check the oil level. Add the required amount of oil to bring the level to the FULL mark. See the *Lubrication* chapter for the type of oil to use.

CHECKING HYDRAULIC OIL LEVEL

The machine must be on level ground with boom lowered and completely retracted. The fluid MUST be cool when checking the reservoir level, to reduce the possibility of overfilling the hydraulic system.

Locate the filler cap next to the side-view mirror on the right side of the machine. Remove the filler cap and check the level on the dipstick. Oil levels anywhere between the upper mark and lower mark on the dipstick is considered full. If the oil is below the lower mark on the dipstick, fill with the required type of oil to bring the level to within the FULL area. See the *Lubrication* chapter for the type of oil to use.

IMPORTANT: *Be careful when removing the reservoir filler cap so that no dirt or other foreign matter enters the hydraulic system. DO NOT OVERFILL.*

CHECKING BRAKE RESERVOIR LEVEL

Flip up the cover on the cab floor in front of the seat. The transparent reservoir on the brake valve has maximum and minimum fill marks on the right side. Visually verify that the fluid level is between these marks. If low, remove the reservoir cap and fill to the proper level with the correct fluid. See the *Lubrication* chapter for the type of fluid to use.

CHECKING TIRE PRESSURES

To ensure proper operating stability and extend tire life, proper and equal tire pressure should be maintained in all four tires.

Check tire pressures “cold.” Inflate as necessary per the chart below:

15.00 x 19.5 - 12 PR: 60 psi (415 kPa)

NOTE: *If the tires have been filled with water or calcium chloride for ballast, a calcium chloride tire pressure gauge MUST be used to check the tire pressure.*

WARNING

Inflating or servicing tires can be dangerous. Whenever possible, trained personnel should service and mount tires. To avoid possible death or serious injury, follow these safety precautions:

1. **BE SURE the rim is clean and free of rust.**
2. **Lubricate both the tire beads and rim flanges with a soap solution. DO NOT use oil or grease.**
3. **DO NOT place fingers on the tire bead or rim during inflation. Use a clip-on tire chuck with a remote hose and gauge, which allows standing clear of the tire while inflating it.**
4. **NEVER inflate beyond 35 psi (240 kPa) to seat the beads. If the beads have not seated by the time the pressure reaches 35 psi (240 kPa), deflate the assembly, reposition the tire on the rim, relubricate both parts and re-inflate. Inflation pressure beyond 35 psi (240 kPa) with unseated beads may break the bead or rim with explosive force sufficient to cause death or serious injury.**
5. **After seating the beads, adjust the inflation pressure to the recommended operating pressure listed.**
6. **DO NOT weld, braze, or otherwise attempt to repair and use a damaged rim.**

To ensure proper load carrying capability, original equipment tires comply with the specifications published in the *Tire and Rim Association Yearbook*. Replacement tires MUST meet the same specifications. When replacing tires, be sure all tires are of the same type, quality and load rating, and the same size as the original equipment. When removing tires, follow industry safety practices. Deflate completely prior to removal. After assembly of the tire on the rim, use a safety cage or restraining device while inflating.

CHECKING WHEEL NUT TORQUE

On new machines, or anytime a wheel has been removed, re-torque wheel nuts until 450 ft.-lbs. (610 Nm) is maintained.

CHECKING INSTRUMENTS OPERATION

Allow the engine to warm up for about five minutes before beginning operation. Indicator lamps should be off and gauges should register normal readings. Tilt the frame from side to side with the frame leveling control and note the frame angle indicator movement.

CHECKING GENERAL MACHINE OPERATION AND CONDITION

Are any decals missing or damaged? Are all guards, shields and covers in place? Do all controls function smoothly and properly? Are there any abnormal vibrations or noises? Are any hose or fitting connections leaking? Is the engine exhaust color normal?

CHECKING PERSONNEL WORK PLATFORM (PWP) SYSTEM (if used)

WARNING

If the PWP System fails to operate properly during any of the System checks, DO NOT USE the machine until the cause has been corrected. Contact your dealer (or Manitou Americas Company) for service information and parts.

Machine Position

The following must be performed before beginning the PWP System checking procedures:

1. Machine on level surface,
2. Boom fully lowered,
3. Frame level,
4. Transmission in “N” (Neutral),
5. Parking brake switch “OFF,”
6. PWP System switch “OFF,”
7. Remote switch plugged in and “ENGAGED.”

Activation Tests

To test the PWP System activation logic:

1. Start the engine and press the PWP rocker switch to “ON.”
   - The PWP System lamp in the switch should be flashing.
2. Apply the service brakes.
   - The PWP switch lamp should be illuminated continuously after three seconds, indicating that the PWP System has been activated.
   - The parking brake should engage, as indicated by the lamp in the parking brake switch illuminating.

- The carriage tilt and auxiliary functions should now be disabled. The joystick control should continue to function normally for boom raise/lower and extend/retract.

Lockout Tests

To test the transmission and joystick control lockout logic:

1. Shift transmission into "F" (Forward) and increase the engine speed slightly.
   - The transmission should remain de-clutched, allowing the engine to increase speed easily.
   - Return the transmission selector to "N" (Neutral) after the check.
2. Have an assistant move the remote shutdown switch to "Dis-engaged."
   - The joystick control should now be disabled, so that boom raise/lower and extend/retract will no longer function.
   - Have the assistant move the remote shutdown switch to "Engaged" after the check.
3. Tilt the frame to the right slightly more than two degrees.
   - The joystick control should now be disabled so that boom raise/lower and extend/retract no longer function.
   - Repeat the procedure with the frame tilted to the left.
   - Return the frame to a level position after the checks.

De-activation Tests

To test the PWP System de-activation logic:

1. Turn the key switch to "OFF" and wait for the engine to stop. Then turn the key switch back to "ON."
   - The PWP switch lamp and the parking brake switch lamp should both be illuminated.
2. Turn the key switch to "OFF" and then turn the PWP rocker switch to "OFF." Turn the key switch back to "ON."
   - The PWP switch lamp should be flashing and the parking brake switch lamp should be on continuously.
3. Start the engine and apply the service brakes.
   - The PWP switch lamp and the parking brake switch lamp should go off after approximately three seconds of brake pedal application.

If PWP System fails to perform properly, troubleshoot using the chart on page 67. Contact your dealer for service information and parts.

Service Every 50 Hours or Weekly

LUBRICATE GREASE POINTS

Refer to the *Lubrication* chapter of this manual for grease fitting locations and other related details.

100 Hours (New Machine Only)

The following initial oil and filter changes should be performed at 100 hours on a new machine. Thereafter these changes should be performed at the regular maintenance intervals. Refer to the maintenance schedules for the necessary procedures.

Engine Oil and Filter	(250 Hours)
Transmission Oil and Filter	(1000 Hours)
Hydraulic Return Filter Element	(1000 Hours)

Torque the boom chains after the first 100 hours of operation on new machines or anytime a chain has been replaced. Thereafter the boom chains should be inspected for wear and proper tension at the regular service interval of 250 hours. Refer to the boom chain torquing procedure in the 250 hour service interval.

Service Every 250 Hours or Quarterly

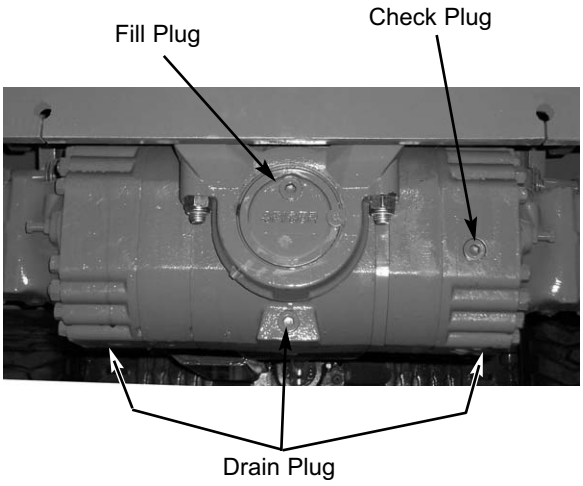
NOTE: *Perform all other service requirements up to this point, as well as the following:*

CHECKING AXLE OIL LEVELS

Differentials

NOTE: *The Telescopic Handler should be on a level surface for this procedure.*

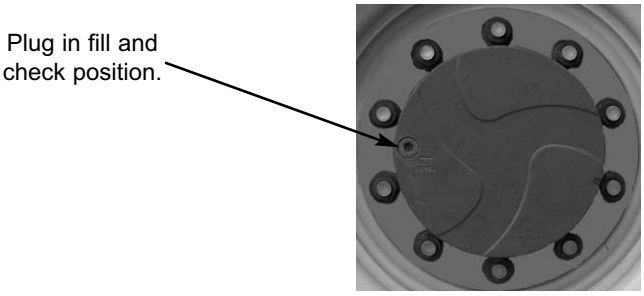
Remove the oil check plug. See illustration below. Oil should flow from the hole. If low, remove the oil fill plug and add oil until it flows from the check hole. Replace the plug, wait 10 to 15 minutes and repeat the fill procedure. Continue this process until the differential is full. See the *Lubrication* chapter for the proper oil specification. Replace the check and fill plugs.



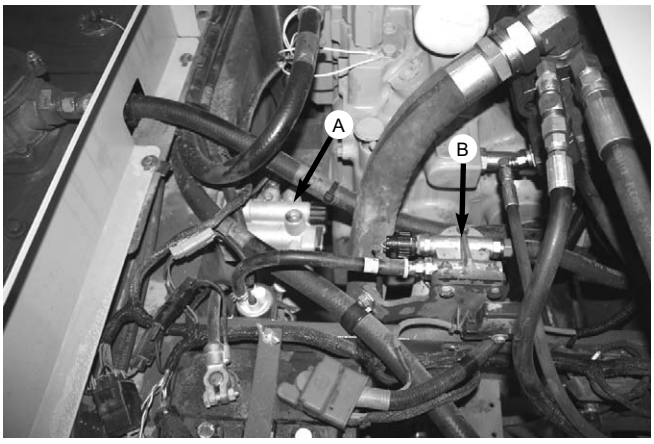
Planetary Hubs

NOTE: *The planetary hubs can be checked without jacking up the machine.*

The planetary hubs have one plug each used for filling and draining. See illustration below. For checking the level and filling, position the wheel until the oil level arrow is horizontal. Remove the plug. If oil does not run out, add oil until it overflows. Check the remaining hubs the same way. Refer to the oil specifications found in the *Lubrication* chapter of this manual.



CHANGING FUEL FILTER



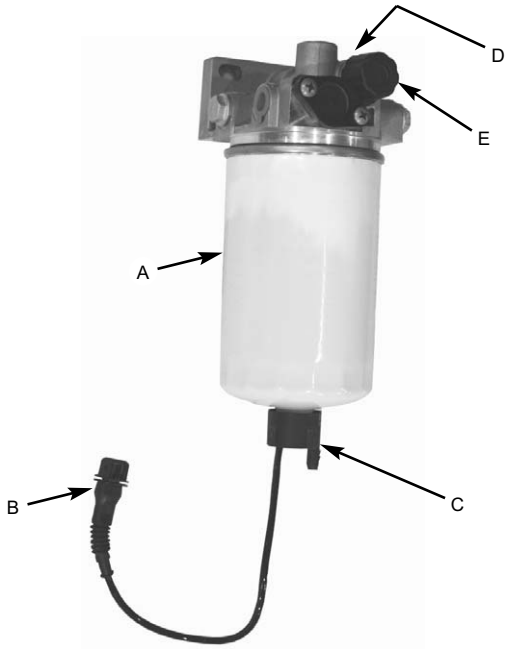
This telehandler is equipped with a primary fuel filter/water separator (A) and a secondary fuel filter (B).

The frequency of filter replacement will be determined by the cleanliness of available fuel, the care used in storing fuel supplies and the operating conditions in which the machine is used.

⚠ WARNING

NEVER service the fuel system while smoking, while near an open flame, or after the engine has been operated and is hot.

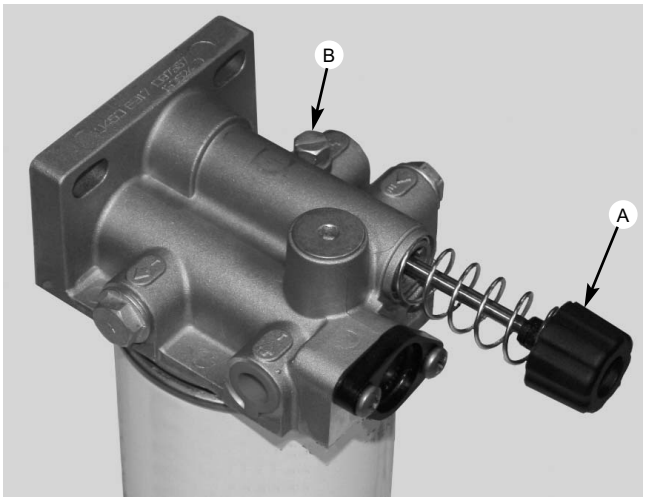
Primary Fuel Filter/Water Separator Replacement



Primary Fuel Filter/Water Separator

1. Thoroughly clean fuel filter assembly and surrounding area.
2. Loosen vent screw (D) on the top of the filter head several turns.
3. Disconnect water sensor wiring (B) from the (A) filter.
4. Loosen drain plug (C) and drain fuel into a suitable container.
5. When fuel has drained, turn the drain plug out completely.
6. Using a filter wrench, remove the filter (A) from the filter head.
7. Inspect filter head for cleanliness. Clean as required.

8. Apply a small amount of fuel to the sealing gasket of the replacement filter.
9. Turn replacement filter onto filter head until the filter contacts the filter head, then turn an additional 3/4 turn.
10. Turn drain plug into filter and re-connect the water sensor wire.
11. To release the fuel priming pump, grasp fuel priming pump knob (A) and push in while turning it counter-clockwise.



Primary Fuel Filter/Water Separator Priming Pump and Vent Screw

12. Operate the priming pump until fuel flows from the vent screw (B) on the top of the filter head.
13. Return the priming pump to the locked position by pushing it fully in and turning it clockwise. Then tighten the vent screw (B).

Secondary Fuel Filter Replacement

Secondary Fuel Filter

1. Thoroughly clean fuel filter assembly and surrounding area.
2. Using a filter wrench, remove the filter from the filter head.
3. Inspect filter head for cleanliness. Clean as required.
4. Apply a small amount of fuel to the sealing gasket of the replacement filter.
5. Turn replacement filter onto filter head until the filter contacts the filter head, then turn an additional 3/4 turn.
6. Loosen vent screw (A) on the top of the filter head several turns.
7. Turn the ignition key to the "ON" position until fuel flows from the vent screw.
8. Tighten the vent screw.

⚠ WARNING

Escaping diesel fuel under pressure can have sufficient force to penetrate the skin. Before applying pressure to the fuel system, BE SURE all connections are tight and lines and hoses are not damaged. Use a piece of wood or cardboard to search for suspected leaks. If injured by escaping fuel, see a doctor familiar with this type of injury at once or gangrene may result.

After fuel filter replacement, start the engine and operate approximately 5 minutes at low idle. Check for fuel leaks.

Diesel Fuel Injectors

Whenever faulty or plugged injectors are indicated, see your authorized engine dealer.

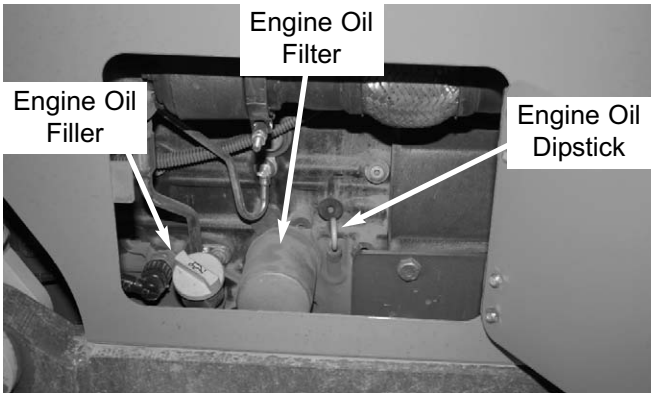
NOTE: *Only an authorized engine dealer can perform warranty service on the engine.*

CHANGING ENGINE OIL AND FILTER

Change the engine oil and filter using the following procedure:

1. With the engine warm, remove the crankcase drain plug located on the left side of the engine oil pan.

IMPORTANT: *DO NOT discharge oil onto ground. Catch and dispose of per local waste disposal regulations.*



2. The engine oil filter should be changed at every oil change interval. Using a suitable filter wrench, remove and discard the filter.

IMPORTANT: *Filtration of oils is critical to proper lubrication. Always change filter with every oil change. Use only genuine OEM engine replacement filters.*

3. Apply a thin coat of clean engine oil to the sealing gasket of the new oil filter.
4. Wipe the filter sealing surface on the engine with a clean cloth.
5. Turn new oil filter on by hand until filter contacts the sealing surface then turn the filter an additional 3/4 turn.
6. Clean and re-install the drain plug.
7. Re-fill the crankcase with new oil. Follow specifications in the *Lubrication* chapter for type and viscosity of new oil.

NOTE: *The oil capacity listed is approximate. Always verify oil level with the engine oil dipstick.*

8. After new oil has been added, run the engine at idle speed until the oil pressure lamp is off. Check for leaks at the filter and drain plug.
9. Verfy the oil level is at the "Full" mark on the engine oil dipstick.

IMPORTANT: *Low engine oil level and over full engine oil levels can cause engine damage.*

CHECKING THE BATTERY

The battery furnished in the machine is a 12-volt, wet-cell battery.

The top of the battery must always be kept clean. Clean the battery with a brush dipped in an alkaline solution (ammonia or baking soda and water). After the foaming has stopped, flush the top of the battery with clean water. If the terminals and cable connection clamps are corroded or have a buildup, disconnect the cables and clean the terminals and clamps with the same alkaline solution.

NOTE: *The battery in the machine is warranted by the supplier. See the punch tag on the top of the battery for warranty information.*

⚠ WARNING

Explosive gas is produced while a battery is in use or being charged. Keep flames and sparks away from the battery. Make sure battery is charged in a well-ventilated area.

NEVER lay a metal object on top of a battery, because a short circuit can result.

Battery acid is harmful on contact with skin or fabrics. If acid spills, follow these first aid tips:

1. **IMMEDIATELY remove any clothing on which acid spilled.**
2. **If acid contacted the skin, rinse the affected area with running water for 10 to 15 minutes.**
3. **If acid comes in contact with the eyes, flood the eyes with running water for 10 to 15 minutes. See a doctor at once. NEVER use any medication or eye drops unless prescribed by the doctor.**
4. **To neutralize acid spilled on the floor, use one of the following mixtures:**
   a. **1 pound (0.5 kg) of baking soda in 4 quarts (4 liters) of water.**
   b. **1 pint (0.4 liters) of household ammonia in 4 quarts (4 liters) of water.**

Whenever battery is removed from the unit, BE SURE to disconnect the negative (-) battery terminal connection first.

Jump Starting

If the battery becomes discharged or does not have enough power to start the engine, use jumper cables and the following procedure to jump-start the engine.

IMPORTANT: *BE SURE that the jumper battery is also a 12-volt D. C. battery, and the vehicle used for jump starting has a negative-ground electrical system.*

⚠ WARNING

The ONLY safe method for jump-starting a discharged battery is for TWO PEOPLE to perform the following procedure. The second person is needed for removing the jumper cables, so that the operator does not have to leave the operator's compartment while the engine is running. NEVER connect the jumper cables directly to the starter solenoid of either engine. DO NOT start the engine from any position other than the operator's seat, and then ONLY after making sure all controls are in "neutral."

Closely follow the jump-start procedures, in the order listed, to avoid personal injury. In addition, wear safety glasses to protect your eyes, and avoid leaning over the batteries while jump-starting.

DO NOT attempt to jump-start the machine if the battery is frozen, because this may cause it to rupture or explode.

1. Turn the key switches on both units to OFF. Be sure that both units are in "Neutral" and NOT touching.
2. Connect one end of the (red) positive (+) jumper cable to the positive (+) battery terminal on the disabled machine first. DO NOT allow the positive (+) jumper cable clamps to touch any metal other than the positive (+) battery terminals. Connect the other end of the positive (+) jumper cable to the jumper battery positive (+) terminal.
3. Connect one end of the (black) negative (-) jumper cable to the jumper battery negative (-) terminal.
4. Make the final negative (-) jumper cable connection to the disabled machine's engine block or frame (ground) — NOT to the disabled machine negative battery post. If making the connection to the engine, keep the jumper cable clamp away from the battery, fuel lines, and moving parts.

NOTE: *Twist the jumper cable clamps on the battery terminals to ensure a good electrical connection.*

5. Start the engine. If it does not start immediately, start the jumper vehicles engine to avoid excessive drain on the booster battery.
6. After the machine has started and is running smoothly, have the second person remove the jumper cables (negative (-) jumper cable first) from the jumper vehicle battery, and then from the disabled machine, while being careful not to short the two cables together.

Allow sufficient time for the alternator to build up a charge in the battery before operating the machine or shutting off the engine.

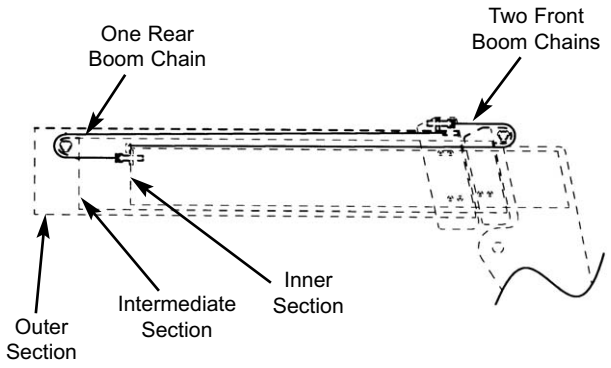
NOTE: *If the battery frequently becomes discharged, have the battery checked for possible dead cells, or troubleshoot the electrical system for possible short circuits or damaged wire insulation.*

CHECKING AND TORQUING BOOM LEAF CHAINS

Inspect the leaf chains for wear and proper tension. Two of the chains are on the top front of the boom. A third chain is accessible from inside the rear of the boom (see boom illustration).

Torque the two chains on the front of the three-section boom to 25 ft.-lbs. (34 Nm). Lubricate with 80W-90 oil.

IMPORTANT: *On new machines or when chains have been replaced, it is necessary to retorque the front double chain assembly after one hundred (100) hours of operation. Failure to do so may allow the chains to become slack, which can result in a chain jumping off a sheave. If this occurs, it could result in severe damage to the boom assembly.*



Chain Hookup Detail

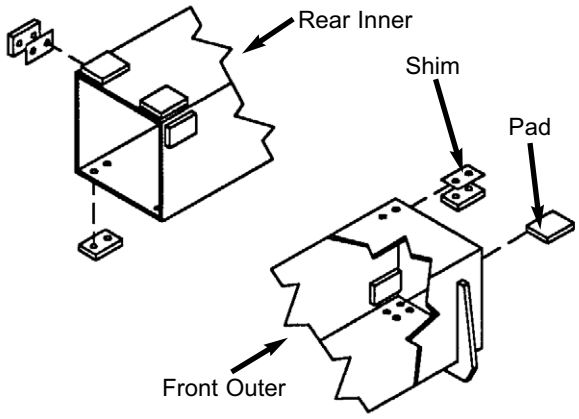
Inspect the leaf chains for wear. Run the boom out slowly to inspect. Conditions to look for include: cracked or broken plates, protruding or turned pins, and excessive wear. With a steel tape, measure 16 links

of the strand that flexes over the sheaves. If the section measures 10.3” (262 mm) or more, the chain should be replaced. DO NOT repair sections of a chain. Replace the complete chain.

Chain anchors and sheaves also require inspection, for worn or broken fingers and worn flanges.

After any chain has been replaced, operate under loaded conditions and re-check the torque. Adjust the chains per the following procedure: Extend the boom to its maximum length, then retract the boom slowly until the chain slack allows the chain to rest on the top of the boom. Torque the two chains on the front of the boom to 25 ft.-lbs. (34 Nm). Lubricate with 80W-90 oil.

CHECKING BOOM SLIDE PAD WEAR AND CLEARANCE



Slide Pad Detail

The boom is equipped with special nylon low-friction slide pads between the telescopic sections (see illustration). These are pre-greased and initially worn-in at the factory. Normally greasing is not required, except for maintaining a light film of grease on the pad tracking areas of the boom sections. An exception is if a boom section has been replaced.

Visually check for loose pad bolts. The bolts are torqued to 30 ft.-lbs. (40 Nm). If the bolts are re-torqued at any time, Loctite® thread lock must be re-applied to the bolts.

If the boom starts to chatter under load, grease the slide pads and wipe off the excess grease. Maintain a clearance of 1/16” between the top or side slide pads and the boom. Shims can be added to achieve the proper clearance. Loosen the bolts and insert shims until proper clearance is obtained.

NOTE: *When inserting shims in the side slide pads, be sure to place equal shims on both sides of the boom for even distribution of clearance.*

Re-apply Loctite® 271 (red) thread lock or equivalent to the bolts and re-torque to 30 ft.-lbs. (40 Nm). Bottom slide pads should not be shimmed and should be replaced when the thickness is worn down to 3/8” (9.5 mm).

WARNING

Failure to maintain proper slide pad clearance and thickness could cause damage to the boom, resulting in sudden boom failure.

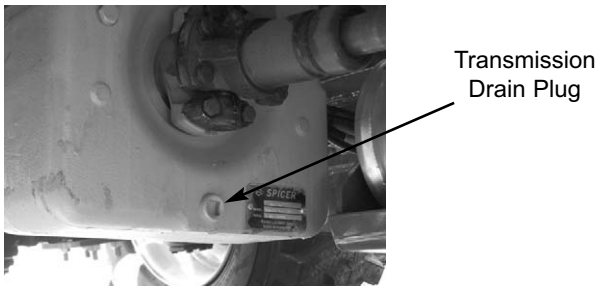
Service Every 1000 Hours or Yearly

NOTE: *Perform all other service requirements up to this point as well as the following:*

CHANGING TRANSMISSION OIL AND FILTER

Operate the machine long enough to warm the transmission oil to 150°-200°F (65°-93°C). Shut off the engine. Access to filter is from under the access cover on the front hood section. Access to the drain plug is from underneath the machine. Proceed as follows:

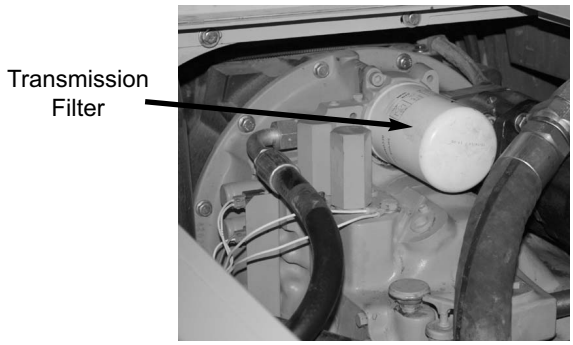
1. Remove the drain plug and drain oil. Replace the drain plug.



IMPORTANT: *DO NOT discharge oil onto ground. Catch and dispose of per local waste disposal regulations.*

2. Remove and discard the oil filter. Wipe the sealing surface on the transmission with a clean cloth. Apply a thin coat of clean oil to the new oil filter gasket. Hand tighten.

3. Refill the transmission with new oil as shown in the *Lubrication* chapter of this manual.



IMPORTANT: *DO NOT OVERFILL! If the oil level is too high, oil foaming, excessively high oil temperature and oil leakage at the seals could result.*

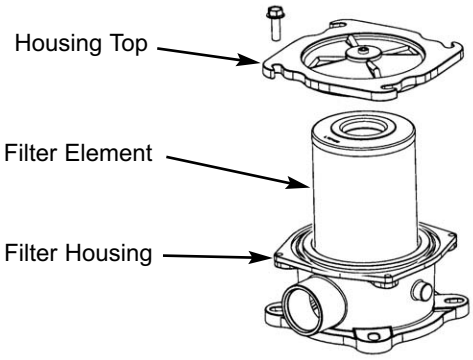
4. Start and run the machine long enough for the oil to circulate and warm slightly. Recheck the level with the dipstick.

CHANGING HYDRAULIC RETURN FILTER ELEMENT

WARNING

Lower the boom to the ground when servicing the hydraulic system.

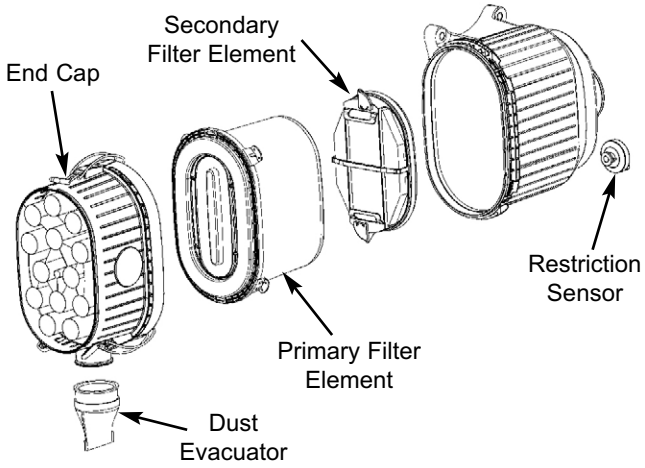
The hydraulic return filter element is a cartridge-type accessible from a housing on top of the hydraulic reservoir. Initial replacement is after the first 100 hours. See illustration. Remove the top cover of the housing. Remove the element and discard. Insert the new element into the housing and replace the cover.



Reservoir Filter Removal

CHANGING AIR FILTER ELEMENTS

IMPORTANT: *Failure to follow proper filter servicing instructions could result in catastrophic engine damage.*



Air Cleaner Assembly

The air cleaner assembly consists of an primary filter element and an secondary filter element. An air filter restriction sensor for monitoring the condition of the elements is located in the front of the air cleaner housing. If the air filter becomes restricted, this sensor will display an air filter restriction message in the multi-function display panel.

NOTE: *The air filter restriction message will clear when the filter element(s) are replaced.*

The primary element should be replaced whenever the air filter restriction message displays. The secondary element should be replaced every third time the primary element is replaced, unless the primary element is damaged or the secondary element is visibly dirty. Along with a daily check of the multi-function display panel for air filter restrictions, check that the air cleaner intake hose and clamps, and the mounting hardware are properly secure.

Unlatch the three latches on the air cleaner and remove the end cap. Clean out any dirt in the end cap.

Primary Element

1. Carefully pull the primary element out of the housing. Never remove the secondary element unless it is to be replaced.
2. Clean out any dirt in the housing. Leave the secondary element installed during this step to prevent debris from entering the engine intake manifold.
3. Inspect the replacement primary filter for any damage before installation. Replace the primary element if any damage is found.

NOTE: *Cleaning the primary filter element is not recommended.*

Secondary Element

NOTE: *Replace the secondary element only if it is visibly dirty or if the primary element has been replaced three times.*

Before removing the secondary element from the housing, clean out any dirt in the housing. Leave the secondary element installed during this step to prevent debris from entering the engine intake manifold. Remove the secondary element.

Reinstallation

IMPORTANT: *NEVER use an element that is damaged. Severe engine wear and eventual failure can result if dirt gets through a hole in the element.*

1. Check inside the housing for any damage that may interfere with the elements.
2. Be sure that the element sealing surfaces are clean.
3. Insert the element(s), making sure that they are seated properly.
4. Secure the end cap to the housing with the three latches.
5. Check the hose connections and make sure they are all clamped and tightened properly.
6. Air filter restriction message in the mult-function display will clear when the air filter(s) are replaced.

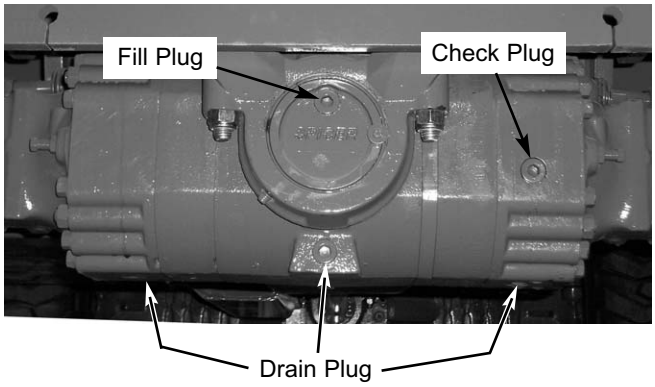
CHANGING AXLE DIFFERENTIAL AND PLANETARY OIL

Differential

1. Remove the three drain plugs and drain the oil. Replace the drain plugs (see illustration).

IMPORTANT: *DO NOT discharge oil onto ground. Catch and dispose of per local waste disposal regulations.*

2. Remove the check and fill plugs. Fill the differential with oil as specified in the *Lubrication* chapter. When the oil flows out the check hole, replace the plug. Wait 10 to 15 minutes and repeat this process until the axle is full. Repeat this procedure with the other axle.

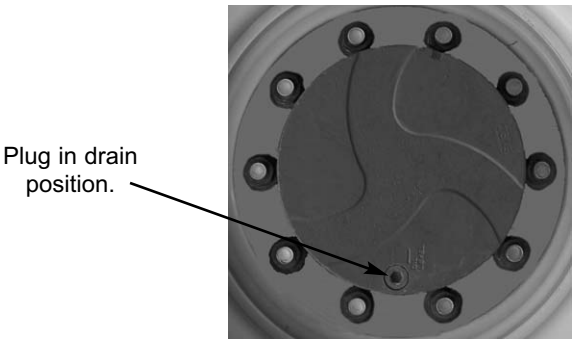


Axle Planetary Hubs

The axle hubs have one plug each used for draining and filling (see illustration).

1. Position the wheel until the oil level arrow points down. Remove the drain/fill plug and allow the oil to drain out. Replace the plug.

IMPORTANT: *DO NOT discharge oil onto ground. Catch and dispose of per local waste disposal regulations.*



2. Re-position the hub so the oil level arrow is horizontal. Fill with fresh oil as specified in the *Lubrication* chapter. When the oil runs out, install the drain/fill plug. Repeat this procedure on the three remaining hubs.

CHECKING ALTERNATOR AND FAN BELT CONDITION

Refer to the engine manual for proper fan belt tension adjustment and replacement procedures. If the belt is worn or cut, it should be replaced. Order replacement belts from your Manitou Americas dealer.

CHECKING EXHAUST SYSTEM

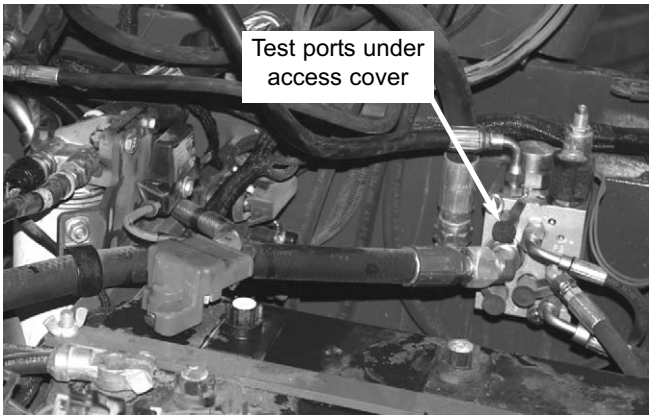
Examine the muffler and tail pipe for possible holes. Re-tighten any loose clamps and make sure the manifold outlet gasket is not leaking.

Service Every 2000 Hours or Two Years

NOTE: *Perform all other service requirements up to this point, as well as the following:*

CHECKING HYDRAULIC SYSTEM RELIEF PRESSURES

Pressure settings for relief valves are pre-set at the factory. Three test ports are provided under the front hood access cover.



Before conducting any pressure checks, check the engine speed. Engine speed must be 1000 RPM at idle and 2300 RPM at high idle

Steering Relief Pressure

Plug a 3000 psi (207 bar) oil- or liquid-filled gauge into the test port labeled ”SP.” Turn the steering full to the right or left. The gauge should read 2000 psi (138 bar).

Joystick and Parking Brake Release Pressure

Plug a 1000 psi (70 bar) gauge into the port labeled “JP.” With the engine running, the gauge should read 350 psi (24 bar).

Main Relief Pressure

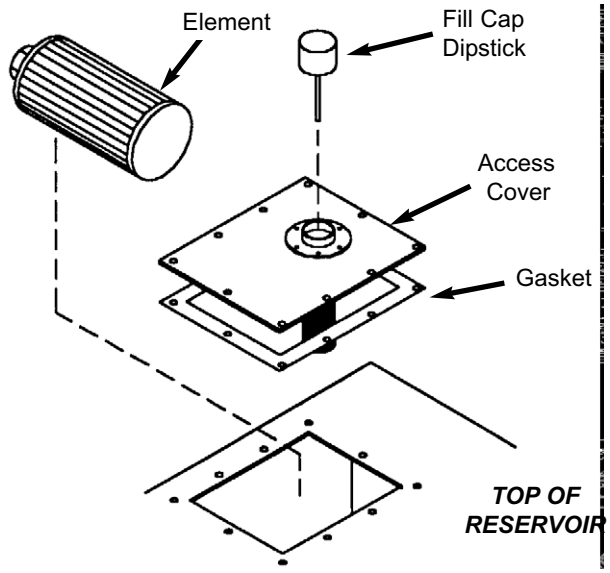
Plug a 3000 psi (207 bar) oil-or liquid-filled gauge into the test port labeled “MP.” Fully retract the boom over the relief valve. The gauge should read 3000 psi (207 bar).

CHANGING HYDRAULIC RESERVOIR OIL AND STRAINER

Clean all dirt and debris from around the top of the reservoir, especially around the access cover. Refer to illustration and use the following procedure:

1. Remove the drain plug and drain oil. Wash or blow off any particles collected on the magnetic drain plug.

IMPORTANT: *DO NOT discharge oil onto ground. Catch and dispose of per local waste disposal regulations.*



Hydraulic Reservoir Sump Strainer Removal

2. Remove the access cover and wash the inlet screen with clean solvent. Remove and wash the sump filter strainer from the bottom inside of the reservoir. If the strainer has any damage, holes, etc., it should be replaced.
3. Flush out the bottom of the reservoir with clean hydraulic oil. Re-install all cleaned components and install the access cover on the reservoir with a new gasket. Clean the filter/breather cap.
4. Fill the reservoir with fresh oil. Follow specifications in the *Lubrication* chapter of this manual.

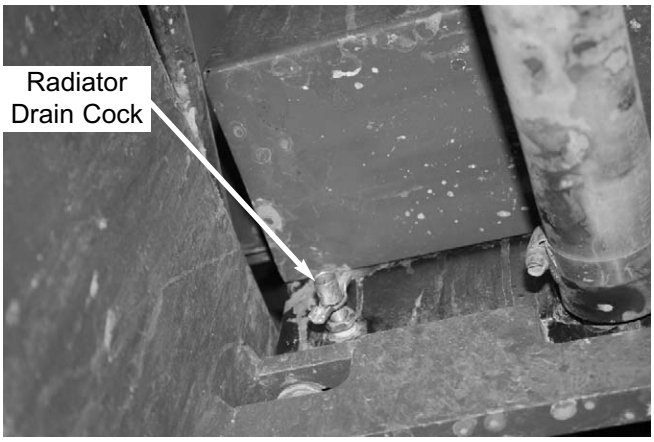
IMPORTANT: *Hydraulic fluid and filters should be replaced any time contamination is present before the normally scheduled change.*

⚠ WARNING

Escaping hydraulic oil under pressure can have sufficient force to penetrate the skin. Before applying pressure to the hydraulic system, be sure all connections are tight and lines and hoses are not damaged. Use a piece of wood or cardboard to search for suspected leaks. If injured by escaping hydraulic oil, see a doctor familiar with this type of injury immediately or gangrene may result.

CHANGING RADIATOR COOLANT

Drain old coolant, and fill with recommended coolant.



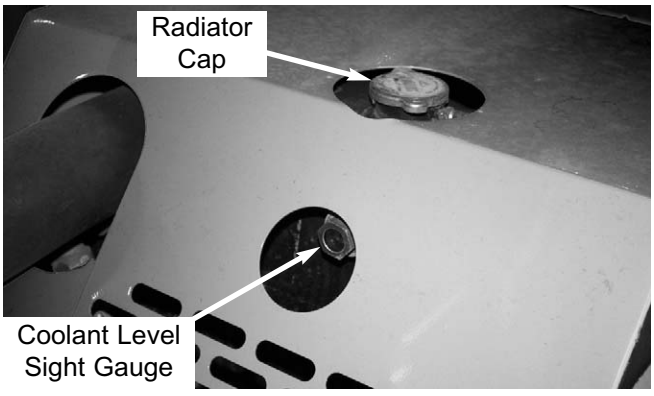
WARNING

Remove the radiator cap only when the engine is cool, or painful burns could result.

1. Loosen the radiator cap to its stop to release any pressure in the radiator. Remove the cap when all pressure is bled off.
2. Place a collection container with a 5 gallon capacity under the right end of the radiator.

IMPORTANT: *DO NOT discharge coolant onto ground. Catch and dispose of per local waste disposal regulations.*

3. Attach a hose to the radiator drain cock and route it to the collection container placed below the radiator.
4. Open the radiator drain cock to drain the radiator.
5. When coolant is completely drained, Close the radiator drain cock.
6. Slowly add coolant to the radiator until the sight glass is filled with coolant.



IMPORTANT: *Fill the cooling system with a low-silicate ethylene glycol based coolant mixed with quality water and supplemental coolant additives (SCAs) suitable for heavy-duty diesel engines. See the engine manual for additional information.*

7. Inspect the radiator cap seal before installing it. Replace it if it appears to be damaged.
8. Start the engine and run it until the engine reaches operating temperature. Check the coolant level through the sight glass. If the coolant is low, allow the engine to cool before removing the radiator cap to add coolant.

NOTE: *Check the engine temperature gauge every minute or two after coolant has been changed. Air pockets can form and it may be necessary to refill the cooling system after a short period of use, as the air will naturally bleed out of the system. Check the sight glass to verify the coolant level before adding coolant.*

STORING THE MACHINE

If the Telescopic Handler will not be operated for a period of three months or more, prepare and store it using the following procedure:

NOTE: *If the storage area is outdoors or in a harsh environment, the storage procedure should be followed if the Telescopic Handler is to be stored for one month.*

Before Storage

Perform the following prior to placing the machine in storage:

1. Wash the entire machine.
2. Lubricate all grease fittings as described in the Lubrication chapter of this manual.
3. Change engine oil as outlined in the Service and Storage chapter of this manual.
4. Apply grease to all exposed hydraulic cylinder rod areas.
5. Disconnect the battery cable clamps and cover the battery, or remove the battery from the machine and store it separately.
6. If the ambient temperature (at any time during the storage period) is expected to drop below freezing, make sure the engine coolant is either completely drained from the radiator and engine block or that the concentration of anti-freeze is adequate to keep

the coolant from freezing. Refer to the engine manual for anti-freeze recommendations and quantities.

During Storage

1. About once each month, connect the battery, check all fluid levels to make sure they are at the proper level, and start the engine.

IMPORTANT: *If it is desired to operate the hydraulic cylinders at this time, BE SURE to wipe the protective grease (and any adhering dirt) from the cylinder rods prior to starting the engine. After operating, if the machine is to be returned to storage recoat the cylinder rods with grease.*

2. Allow the engine to run until it warms up. Then move the machine a short distance to help relubricate the internal parts. Run the engine until the battery is recharged, and then shut it off.

After Storage

After removing the machine from storage and BEFORE operating it, perform the following:

1. Change engine oil and filter to remove any condensation and residues.
2. Wipe off grease from cylinder rods.
3. Lubricate ALL grease fittings.
4. Follow the start-up and warm-up procedures outlined in the *Operation and Adjustments* chapter of this manual.

PWP SYSTEM TROUBLESHOOTING

Problem	Possible Cause	Remedy
PWP System switch lamp flashes when switch is pressed “ON.” Parking brake does not engage when the PWP System switch is pressed “ON.” Carriage tilt and auxiliary functions continue operating when the PWP System switch is pressed “ON.” Transmission does not remain de-clutched when shifted into “Forward or Reverse” when the PWP switch is “ON.”	PWP System is not activated.	With PWP System switch “ON,” apply service brakes for three seconds until PWP switch lamp is lit continuously.
Boom control functions do not operate.	Machine is not level. PWP System remote shutdown switch is disengaged. PWP System remote shutdown switch is not plugged into the connector at the end of the boom. PWP System angle sensor is unplugged or faulty.	Level the machine. Engage the PWP System remote shutdown switch. Plug in and engage the PWP System remote shutdown switch. Contact your Manitou Americas dealer for assistance.
PWP System switch lamp flashes when switch is turned “OFF.” Parking brake switch lamp stays “ON” when PWP System switch is “OFF.”	PWP System is not de-activated.	With engine running, apply service brakes for three seconds until PWP switch lamp goes off.

Chapter 9

DECAL LOCATIONS

GENERAL INFORMATION

CAUTION

ALWAYS read and follow the safety precautions and information shown on decals. If any decals are damaged or unreadable, or if the unit is repainted, the decals must be replaced. If repainting, BE SURE that all decals that apply to your machine are affixed in their proper locations

Decal location information is provided to assist in the proper selection and application of new decals, in the event the original decals become damaged or the machine is repainted.

For correct replacement of decals, compare the location photographs to the machine before starting to refinish the unit. Check off each required decal using the illustration reference number to find the part number, description and quantity in the list. Refer to the appropriate illustration for replacement locations.

If there is a decal on a part that is being replaced, be sure that the decal is applied to the replacement part.

NOTE: *Refer to the Safety chapter of this manual for specific information provided on the various safety decals.*

NEW DECAL APPLICATION

Before applying the new decals, surfaces must be free from dirt, dust, grease and other foreign material. To apply a solid-formed decal, remove the smaller portion of the decal backing paper and apply this part of the exposed adhesive backing to the clean surface while maintaining proper position and alignment. Slowly peel off the other portion of the backing paper while applying hand pressure to smooth out decal surface. To apply a die-cut decal, first remove the backing paper. Then, properly orient and position the decal onto the clean mounting surface. After the decal is firmly applied and smoothly pressed down, peel off the top covering paper.

PAINT FINISH

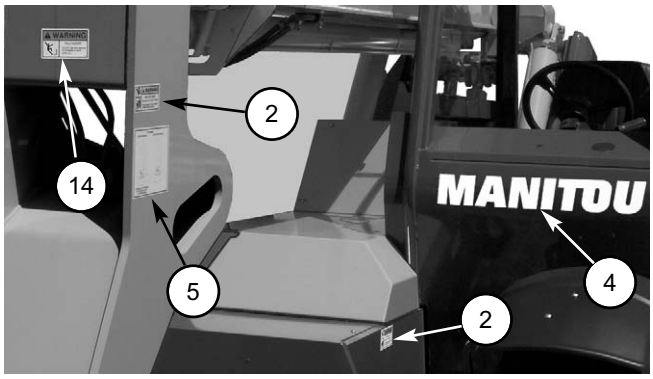
Use this list to order paint for refinishing:

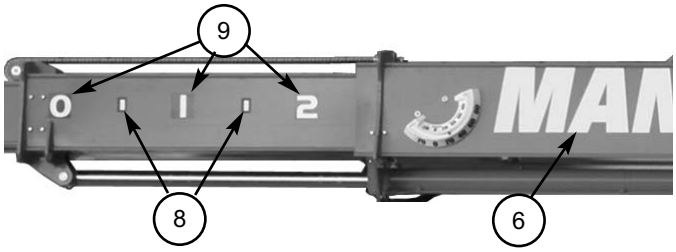
808020	One Gallon Red
808021	6 (12-oz. Spray Cans) Red
808043	One Gallon Gun-Metal Gray
808044	6 (12-oz. Spray Cans) Gun-Metal Gray

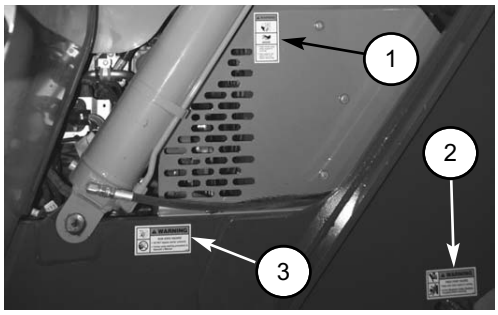
Decal Kits

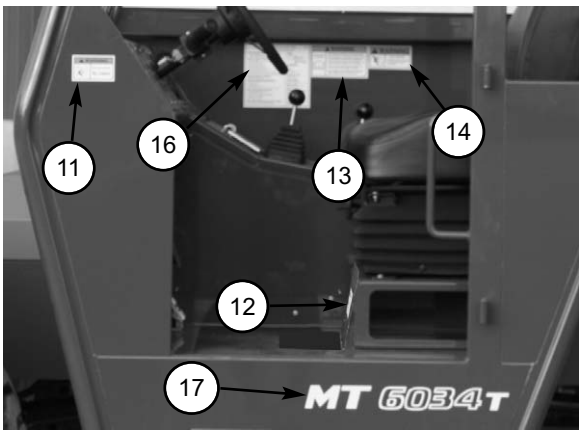
50220765	MT6034T Telescopic Handler without PWP
50220766	MT6034T Telescopic Handler with PWP

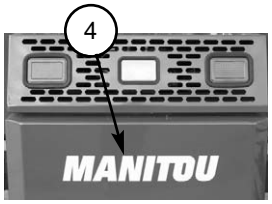
NOTE: *Decals may be purchased in kits or individually.*

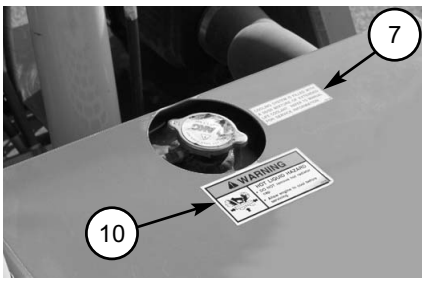






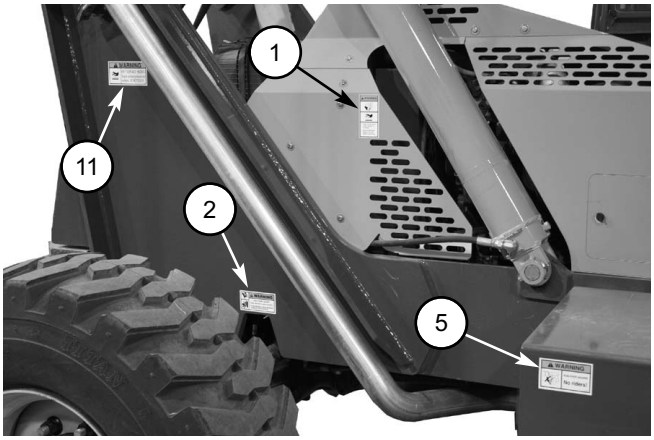


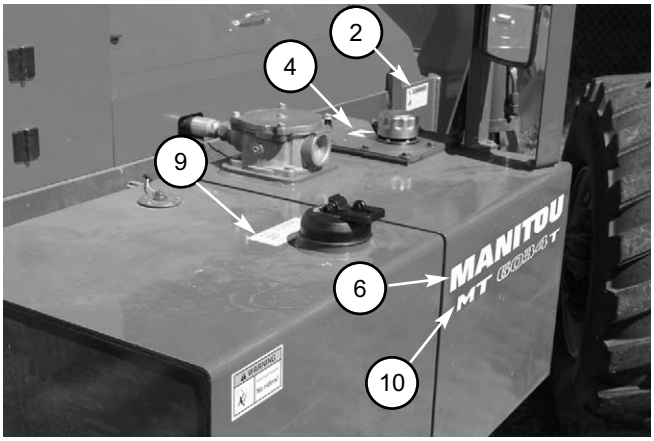


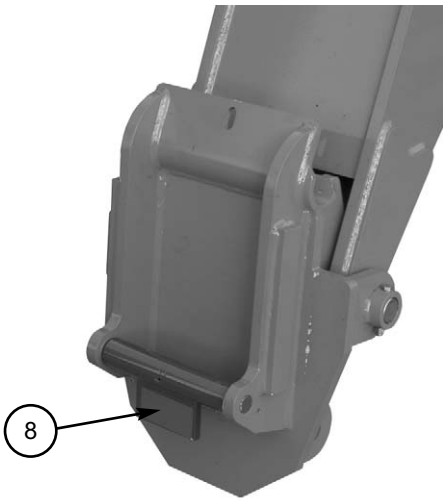


DECAL LOCATIONS - FRAME AND BOOM

REF. NO.	DESCRIPTION	PART NO.
01	DANGER - HANDS OUT	808036
02	WARNING - PINCH POINT	808033
03	WARNING - JUMP START	808034
04	MANITOU LOGO, SMALL	50380379
05	QUICK-ATTACH DIAGRAM	808046
06	MANITOU LOGO, LARGE	806320
07	ANTI-FREEZE	808047
08	HALF ZONE MARKER (5 ea.)	808048
09	NO. “0” EXTENSION MARKER (1 ea.)	809561
	NO. “1” EXTENSION MARKER (1 ea.)	808049
	NO. “2” EXTENSION MARKER (1 ea.)	808050
	NO. “3” EXTENSION MARKER (1 ea.)	808051
	NO. “4” EXTENSION MARKER (1 ea.)	808052
	NO. “5” EXTENSION MARKER (1 ea.)	808053
10	COOLANT UNDER PRESSURE	808054
11	WARNING - NO RIDERS	808035
12	BRAKE FLUID	808055
13	OPERATOR MANUAL WARNING	808032
14	DANGER - PERSONNEL INJURY *(units without PWP)*	808031
15	CARRY LOAD LOW	808037
16	LUBE CHART	50305007
17	MT 6034 T	51200618

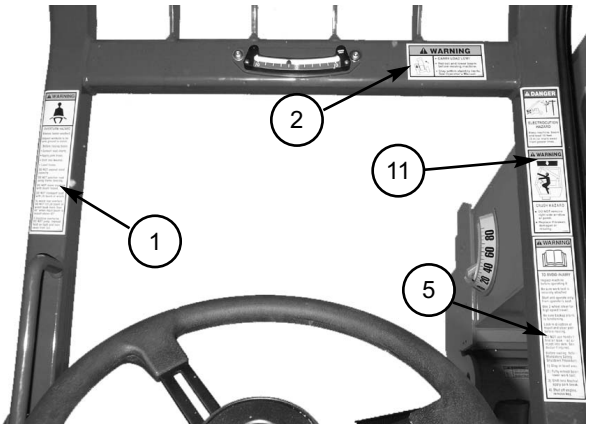




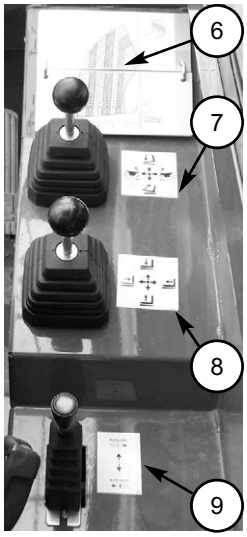


DECAL LOCATIONS - FRAME AND BOOM

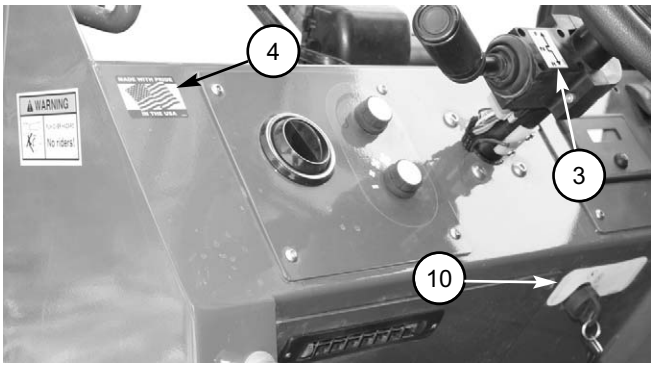
REI. NO.	DESCRIPTION	PART NO.
01	DANGER - HANDS OUT	808036
02	WARNING - PINCH POINT	808033
03	MANISCOPIC	51200619
04	HYDRAULIC OIL FILL	808057
05	WARNING - NO RIDERS	808035
06	MANITOU LOGO, SMALL	50380379
07	WARNING - CARRY LOAD LOW	808037
08	QUICK-ATTACH UNLOCKED	808038
09	DIESEL FUEL	50301416
10	MT 6034 T	51200618
11	HOT SURFACE	809291



Tri-Function
Joystick Control

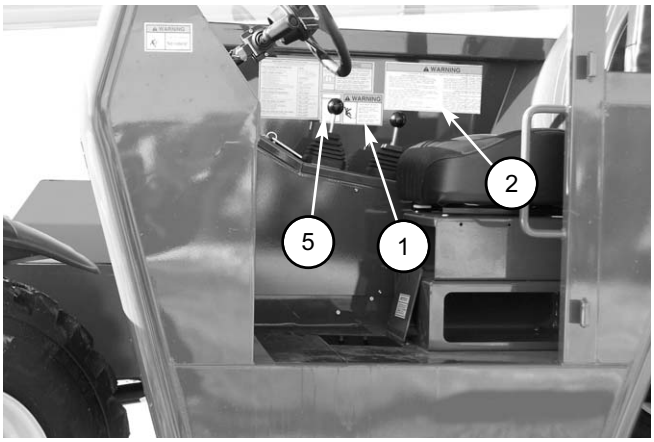


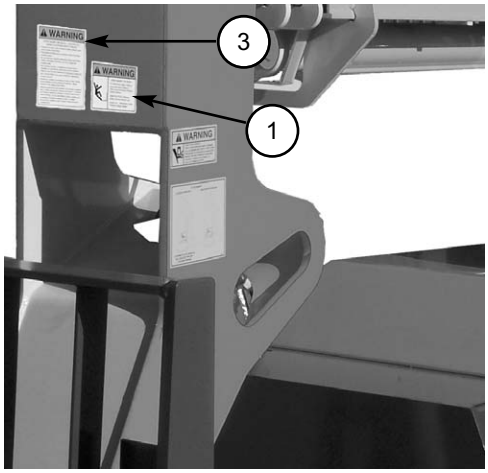
Two Joystick Control

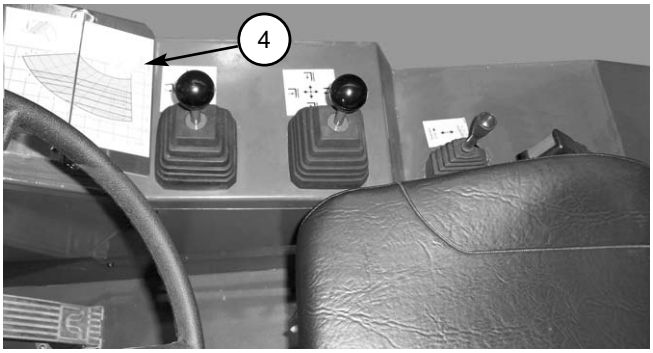


DECAL LOCATIONS - OPERATOR STATION

REI. NO.	DESCRIPTION	PART NO.
01	WARNING - TILT HAZARD/GENERAL OPERATOR	808027
02	WARNING - CARRY LOAD LOW	808026
03	F-N-R SHIFT	808059
04	MADE IN USA	808060
05	WARNING - PARK BRAKE/SEAT BELT	808030
06	STANDARD CARRIAGE LOAD CHART	809299
	ROTATING CARRIAGE LOAD CHART	809301
	BUCKET LOAD CHART	809300
	TRUSS BOOM LOAD CHART	809302
	WINCH LOAD CHART	809303
	PWP LOAD CHART	809304
07	ATTACHMENT TILT/FRAME LEVEL	808061
08	BOOM CONTROL	808062
09	AUXILIARY HYDRAULIC CONTROL *(Optional)*	808064
10	IGNITION SWITCH	50304691
11	DANGER - HIGH VOLT./MOVING PARTS	808029
12	JOYSTICK CONTROL	51200536
13	FRAME LEVEL	809307







DECAL LOCATIONS - PWP EQUIPPED UNITS

REI. NO.	DESCRIPTION	PART NO.
01	WARNING - PERSONNEL LIFT	808039
02	WARNING - WORK PLATFORM RULES	808040
03	PERSONNEL LIFT SAFETY RULES	808041
04	PWP LOAD CHART	809304
05	PWP SWITCH	808042

Chapter 10

MAINTENANCE

This Maintenance Interval Chart was developed to match the *Service and Storage* chapter of this manual. Detailed information on each Service Procedure is in the *Service and Storage* chapter. A Maintenance Log follows the Maintenance Interval Chart for recording the maintenance procedures performed. Recording the 10-Hour (or Daily) service procedures is impractical and is therefore not recommended.

IMPORTANT: *Under severe operating conditions, more frequent service than the recommended intervals may be required. Users must decide if the severity of their operation requires more frequent service than normal.*

MAINTENANCE INTERVAL CHART

SERVICE PROCEDURE	Every 10 Hours (or Daily)	Every 50 Hours (or Weekly)	First 100 Hours	Every 250 Hours (or Quarterly)
Check Fuel Tank Level	●			
Check Fuel Filter (Drain Water If Required)	●			
Check Engine Oil Level	●			
Check Radiator Coolant Level	●			
Check Transmission Oil Level	●			
Check Hydraulic Oil Level	●			
Check Brake Reservoir Level	●			
Check Tire Pressures	●			
Check Wheel Nut Torque	●[1,2]			
Check Instruments Operation	●			
Check General Machine Operation and Condition	●			
Check Personnel Work Platform Safety System	●			
Lubricate Grease Points		●		
Change Engine Oil and Filter			●[2]	
Change Transmission Oil and Filter			●[2]	
Change Hydraulic Oil Filter			●[2]	
Check Axle Oil Levels				●
Change Fuel Filter				●
Change Engine Oil and Filter				●
Check Battery				●
Check and Torque Boom Leaf Chains			●[3]	●

1 - On new machines, or when a wheel has been removed, until 450 ft.-lbs. (610 Nm) is maintained.
2 - New machines only.
3 - On new machines or when a chain has been replaced. Chains should be torqued to 25 ft.-lbs. (34 Nm).

MAINTENANCE INTERVAL CHART (CONT.)

SERVICE PROCEDURE	Every 250 Hours (or Quarterly)	Every 1000 Hours (or Yearly)	Every 2000 Hours (or Two Years)
Check Boom Slide Pads Wear and Clearance	●		
Change Transmission Oil and Filter		●	
Change Hydraulic Return Filter Element		●	
Change Air Filter Element		●	
Change Axle Differential and Planetary Oil		●	
Check Alternator and Fan Belt Condition		●	
Check Exhaust System		●	
Check Hydraulic System Relief Pressures			●
Change Hydraulic Reservoir Oil and Strainer			●
Change Radiator Coolant			●

MAINTENANCE LOG

Date	Hours	Service Procedure

MAINTENANCE LOG

Date	Hours	Service Procedure

MAINTENANCE LOG

Date	Hours	Service Procedure

ENGINE DIAGNOSTIC TROUBLE CODES (DTCs)

Engine diagnostic trouble codes are displayed in the multi-function display screen.

Diagnostic trouble codes are displayed as a two-part code: Suspect Parameter Number (SPN) and Failure Mode Identifier (FMI), as shown on the following table.

The first part is a Suspect Parameter Number (SPN) followed by a Failure Mode Identifier (FMI). To determine the exact type of failure, both parts (SPN and FMI) of the code are needed.

The SPN identifies the system or the component that has the failure; for example, SPN 000110 indicates a failure in the engine coolant temperature sensor.

The FMI identifies the type of failure that has occurred; for example, FMI 03 indicates a value above normal. Combining SPN 000110 with FMI 03 means the engine coolant temperature input voltage is too high. This example would display in the multi-function display as error code 000110-03.

Always contact your servicing engine dealer for help in correcting the diagnostic trouble codes that are displayed for the engine.

The fault code listing in the following tables are in ascending SPN/FMI codes.

DTC			
SPN	**FMI**	**Error Code Type**	**Error Description**
51	03	EGR Valve Actuator Error	Actuator of the external EGR valve: the ECU detects a short circuit to battery; short cut to battery on ECU pin A19 or pin A20;
51	04	EGR Valve Actuator Error	Actuator of the external EGR valve: The ECU detects a short circuit to ground; Short cut to ground on ECU pin A19 is detected; measured voltage by ECU is under limit
51	05	EGR Valve Actuator Error	Actuator error EGR Valve: signal range check low, measuredcurrent is blow target; open load on ECU output is detected
51	06	EGR Valve Actuator Error	Actuator error EGR Valve: signal range check high, measured current by ECU is over target; too high current is going into the actuator, output is switched off; overload by short-circuit
51	07	EGR Valve Actuator Error	Actuator position for EGR Valve is not plausible, internal error, angular misalignment of the flap
51	11	EGR Valve Actuator Error	Actuator EGR valve: temperature limit in power-stage of the actuator is reached due to high current
91	03	Accelerator Pedal Sensor Error	Analog accelerator pedal sensor 1: the voltage measured by ECU is out of the target
91	04	Accelerator Pedal Sensor Error	Analog accelerator pedal sensor 1: the voltage measured by ECU is out of the target
91	11	Accelerator Pedal Sensor Error	Plausibility error between APP1 and idle switch
94	01	Low Fuel Pressure Sensor Error	Low fuel pressure: the low fuel pressure calculated by ECU is underneath the target range; the ECU activates a system reaction
94	03	Low Fuel Pressure Sensor Error	Low fuel pressure: the voltage of sensor measured by ECU is out of the target range, high

DTC			
SPN	**FMI**	**Error Code Type**	**Error Description**
94	04	Low Fuel Pressure Sensor Error	Low fuel pressure: the voltage of sensor measured by the ECU is out of the target range, low
97	03	Water in Fuel Sensor Error	Fuel filter water level sensor: the voltage of sensor measured by ECU is out of the target range, high
97	04	Water in Fuel Sensor Error	Fuel filter water level sensor: the voltage of sensor measured by ECU is out of the target range, low
97	12	Water in Fuel Sensor Error	Fuel filter water level sensor: the maximum level is exceeded
100	01	Oil Pressure Sensor Error	Oil pressure is below the target range: warning, power reduction or shutdown threshold
100	03	Oil Pressure Sensor Error	Oil pressure sensor: the voltage of sensor measured by ECU is out of target range, high
100	04	Oil Pressure Sensor Error	Oil pressure sensor: the voltage of sensor measured by ECU is out of target range, low
102	02	Charge Air Pressure Sensor Error	Charge air pressure measured by sensor is above the warning threshold or shutdown threshold
102	03	Charge Air Pressure Sensor Error	Charge air pressure sensor: the measured voltage of sensor by ECU is out of the target range, high
102	04	Charge Air Pressure Sensor Error	Charge air pressure sensor: the measured voltage of sensor by ECU is out of the target range, low
105	00	Charge Air Temperature Sensor Error	Charge air temperature downstream calculated by ECU is above the taget range: the ECU activates a warning threshold or shutdown threshold
105	03	Charge Air Temperature Sensor Error	Charge air temperature Sensor: the voltage of sensor measured by ECU is out of target range, high
105	04	Charge Air Temperature Sensor Error	Charge air temperature Sensor: the voltage of sensor measured by ECU is out of target range, low
107	00	Air Filter Differential Pressure Sensor Error	Air filter differential pressure: the pressure difference of the intake air between the filter inlet and outlet calculated by ECU is above the target range and the ECU activates a warning threshold
110	00	Coolant Temperature Sensor Error	Coolant temperature: the coolant temperature calculated by ECU is above the target range; the ECU activates a warning power reduction or a shutdown threshold

DTC			
SPN	**FMI**	**Error Code Type**	**Error Description**
110	03	Coolant Temperature Sensor Error	Coolant Temperature sensor: the voltage of the sensor measured by ECU is out of the target range, high
110	04	Coolant Temperature Sensor Error	Coolant Temperature sensor: the voltage of the sensor measured by ECU is out of the target range, low
111	01	Coolant Level	Coolant Level: the coolant level calculated by the ECU is underneath the allowed minimum
157	03	Rail Pressure Sensor Error	Rail Pressure Sensor: the voltage of sensor measured by ECU is out of target range, high
157	04	Rail Pressure Sensor Error	Rail Pressure Sensor: the voltage of sensor measured by ECU is out of target range, low
168	00	Battery Voltage Sensor Error	Battery Voltage: the voltage measured by ECU is out of the target range, high
168	01	Battery Voltage Sensor Error	Battery Voltage: the voltage measured by ECU is out of the target range, low
168	02	Battery Voltage Sensor Error	Battery Voltage: the voltage measured by ECU is out of the target range, battery voltage above warning threshold
168	03	Battery Voltage Sensor Error	Battery Voltage: the voltage measured by ECU is out of the target range, battery voltage above warning threshold, short cut to battery
168	04	Battery Voltage Sensor Error	Battery Voltage: the voltage measured by ECU is out of the target range, battery voltage above warning threshold, short cut to ground
190	00	Engine Speed	Maximum engine speed exceeded
190	02	Engine Speed	ECU measures a offset angle between crankshaft and camshaft sensor is too large
190	08	Engine Speed	Camshaft Speed Sensor: ECU recieves no signal, uses crankshaft sensor to calculate engine speed Crankshaft Speed Sensor: disturbed signal
190	11	Engine Speed	Engine Speed: the engine speed calculated by ECU is above the target range, the ECU activates a warning threshold
190	12	Engine Speed	Crankshaft Speed Sensor Unavailable: ECU uses camshaft speed sensor. Speed detection; out of range, signal disrupted, erratic signal
190	14	Engine Speed	Engine Speed: the engine speed calculated by ECU is above the target range, the ECU activates a engine speed warning threshold
630	12	EEPROM Error	The ECU finds an erroe during the access to its EEPROM memory or works with an alternative value

DTC			
SPN	**FMI**	**Error Code Type**	**Error Description**
639	14	CAN-Bus error	CAN-Bus “BusOff-Status”
651	03	Electrical Error	Injector Cyl. 1: the current drop measure by ECU is above the target range, shor circuit to injector 1
651	05	Electrical Error	Injector Cyl. 1: interuption of electrical connection
652	03	Electrical Error	Injector Cyl. 3: the current drop measure by ECU is above the target range, shor circuit to injector 1
652	05	Electrical Error	Injector Cyl. 3: interuption of electrical connection
653	03	Electrical Error	Injector Cyl. 4: the current drop measure by ECU is above the target range, shor circuit to injector 1
653	05	Electrical Error	Injector Cyl. 4: interuption of electrical connection
654	03	Electrical Error	Injector Cyl. 2: the current drop measure by ECU is above the target range, shor circuit to injector 1
654	05	Electrical Error	Injector Cyl. 2: interuption of electrical connection
677	03	Starter Relay Error	Starter Relay (high side power stage): The current drop measured by ECU is above the target range; starter relay high side short circuit to battery. Starter Relay (high side power stage): The current drain measured by ECU is above the target range; starter relay low side, short circuit to battery
677	04	Starter Relay Error	Starter Relay (high side power stage): The current drop measured by ECU is above the target range; starter relay low side short circuit to ground. Starter Relay (high side power stage): The current drain measured by ECU is above the target range; starter relay high side, short circuit to ground
677	05	Starter Relay Error	Starter Relay (low side power stage): the current drop measured by ECU is above the target range; open circuit/disconection LowSide-Outout
677	12	Starter Relay Error	Starter Relay (low side power stage): the current drop measured by ECU is above the target range; starter relay powerstage over temperature
898	09	Timeout Error	Timeout error: limp mode activated
1079	13	(ECU) Erro	Internal Hardware Monitoring: the ECU detects a deviation of the target range of the power supply voltage of sensor output 1
1080	13	(ECU) Error	Internal Hardware Monitoring: the ECU detects a deviation of the target range of the power supply voltage of sensor output 2
1109	02	Engine Shut-off Error	Operator ignors the engine shut off request within an allowed period.

DTC			
SPN	**FMI**	**Error Code Type**	**Error Description**
1231	14	CAN BusOff Error	CAN Bus 1: the ECU is not allowed to send messages, because the status “BusOff” is detected
1237	02	Override Switch Error	Override Switch: the ECU receives a permanent signal, plausibility error
523009	09	Pressure Relief Valve Error	Rail Pressure Relief Valve: reached maximum allowed opening count
523009	10	Pressure Relief Valve Error	Rail Pressure Relief Valve: reached maximum allowed opening time
523350	04	Injector Short Circuit Error	Injector Cylinder - Bank 1: short circuit
523352	04	Injector Short Circuit Error	Injector Cylinder - Bank 2: short circuit
523354	12	Injector Error	ECU detects an error of its injector high current output; injector powerstage output defect
523470	02	Pressure Relief Valve (PRV) Error	PRV will be forced to open; performed by pressure increase. PRV: is open, will be forced to open, the forced open failed; performed by pressure shock
523470	07	Pressure Relief Valve (PRV) Error	Rail pressure is out of the expected range; Maximum rail pressure in limp home mode exceeded, monitoring for maximum rail pressure in limp home mode with PRV
523470	11	Pressure Relief Valve (PRV) Error	Rail pressure relief valve can’t be opened due to rail pressure; PRV error; rail pressure out of tolerance range; average rail pressure is outside the expected tolerance range
523470	12	Pressure Relief Valve (PRV) Error	Rail pressure relief valve open; PRV forced to open; system reaction initiated, fault path indicating shutoff condition in case of open PRV; power reduction may result
523470	14	Pressure Relief Valve (PRV) Error	Rail pressure relief valve open;PRV is open; PRV in rail is open; power reduction may result
523550	12	T50 Start Switch Error	Terminal 50: ECU receives a permanent signal; T50 start switch active for too long; Start information to starter T50 Switch erratic/defect
523601	13	Sensor Supply Voltage Monitor 3 Error	Internal Hardware Monitoring:the ECU detects a deviation of the target range of the power supply voltage of sensor output 3
523612	12	Software Error	ECU Internal software error; power reduction may result. Internal ECU monitoring detection reported error
523612	14	Software Error	Internal Hardware Monitoring: ECU CPU reset and cause is logged internally; no item created in error memory; software reset CPU, software visibility resets in DSM

DTC			
SPN	**FMI**	**Error Code Type**	**Error Description**
523613	00	Rail Pressure Error	Rail Pressure: fuel pressure in rail below target range dependant on engine speed; rail pressure disrupted, Positive governor deviation; maximum positive rail pressure deviation exceeded concerning set fuel flow; power reduction may result
			Rail Pressure: fuel pressure in rrail exceeds target range dependant on engine speed; rail pressure disrupted, maximum negative rail pressure deviation with metering unit on lower limit is exceeded
			Rail Pressure: fuel pressure in rail exceeds target rage dependant on engine speed; rail pressure disrupted, leakage detected based on fuel quantity balance; power reduction may result
			Rail Pressurre: fuel pressure in rail exceeds target range dependant on engine speed; rail pressure disrupted, maximum rail pressure exceeded
523613	01	Rail Pressure Error	Rail Pressure: fuel pressure in rail calculated by ECU is below the target range which is dependant on engine speed; minimum rail pressure exceeded
523613	02	Metering Unit Error	Rail Pressure: fuel pressure in rail calculated by ECU is below the target range which is dependant on engine speed; setpoint of metering unit in overun mode not plausible
523615	03	Metering Unit Error	Fuel Metering Unit: current drain measured by ECU is above the target range; short circuit to battery high side; short circuit to battery low side
523615	04	Metering Unit Error	Fuel Metering Unit: current drain measured by ECU is above the target range; short circuit to ground high side; short circuit to ground low side
523698	11	SCR Error	Engine Shut Off request from supervisory monitoring function
523776	09	Timeout Error	Timeout Error; limp mode activated
523777	09	Passive Timeout Error	Passive Timeout Error; limp mode activated
523895	13	Injector Adjustment Error	Missing or wrong injector adjustment value programming (IMA) injector 1
523896	13	Injector Adjustment Error	Missing or wrong injector adjustment value programming (IMA) injector 3
523897	13	Injector Adjustment Error	Missing or wrong injector adjustment value programming (IMA) injector 4
523898	13	Injector Adjustment Error	Missing or wrong injector adjustment value programming (IMA) injector 2

DTC			
SPN	**FMI**	**Error Code Type**	**Error Description**
523906	03	Fuel Pump Error	ECU detects short cut to battery in fuel feed pump circuit; electric fuel pre-supply pump short circuit to battery
523906	04	Fuel Pump Error	ECU detects short cut to ground in fuel feed pump circuit; electric fuel pre-supply pump short circuit to ground
523906	05	Fuel Pump Error	ECU detect open load on the electric fuel feed pump output: electric fuel pre-supply pump open load, cable break
523906	12	Fuel Pump Error	ECU detects to high temperature in powerstage of fuel pump circuit; electric fuel pre-supply pump powerstage over temperature
523982	00	Powerstage Diagnosis Disabled	Powerstage Diagnosis Disabled; high battery voltage
523982	01	Powerstage Diagnosis Disabled	Powerstage Diagnosis Disabled; low battery voltage
524057	02	Fuel Pressure Error	Electric Fuel Pump; fuel pressure build up error
524108	09	Timeout Error	Missing CAN message of EGR throttle valve; Timeout Error of CAN-Transmit-Frame ComEGRTVActr, Missing CAN Bus message
524109	09	Timeout Error	Missing message of EGR throttle valve; Timeout error of CAN-Receive-Frame ComRxEGRTVActr, Missing CAN Bus message

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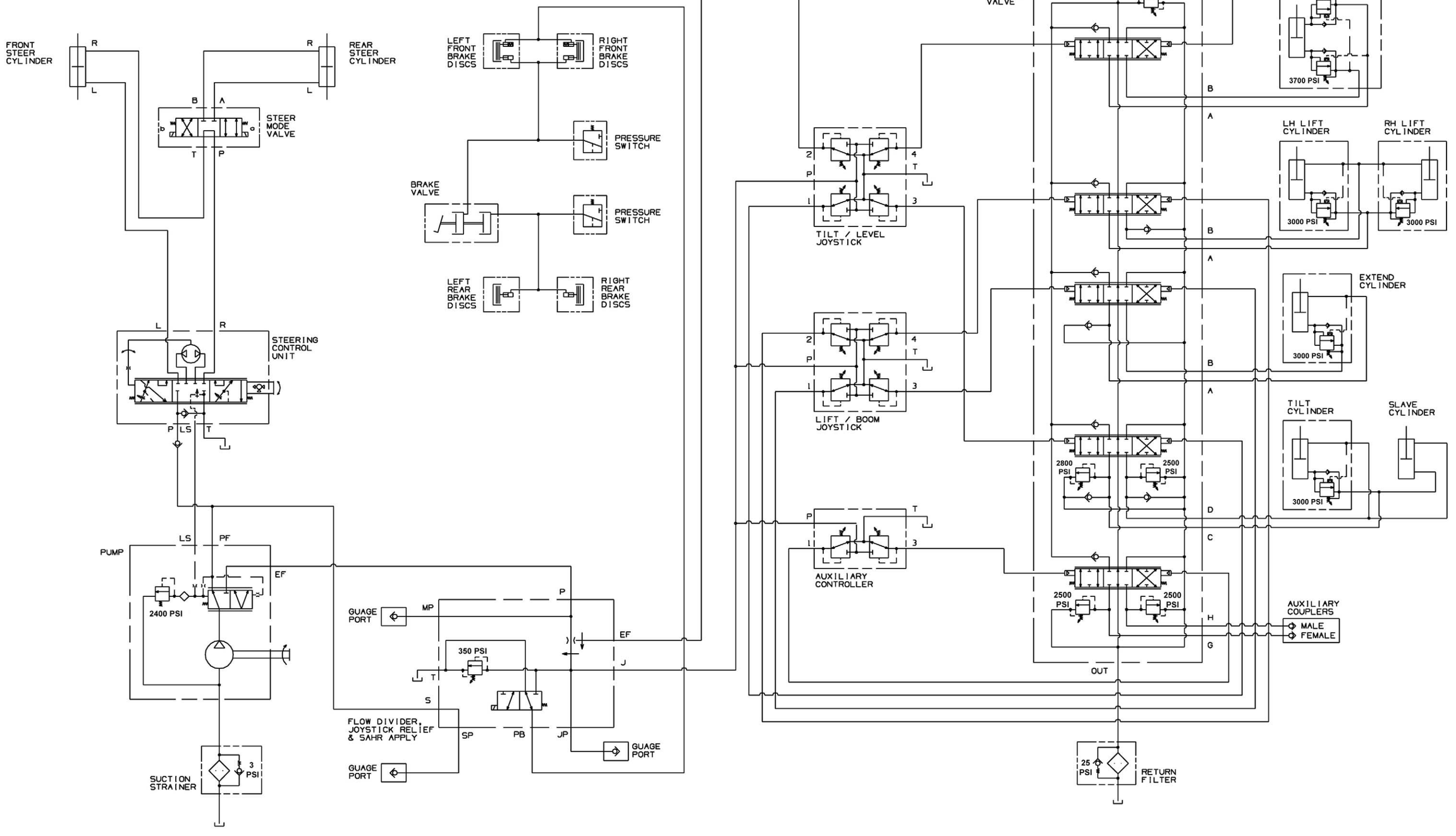
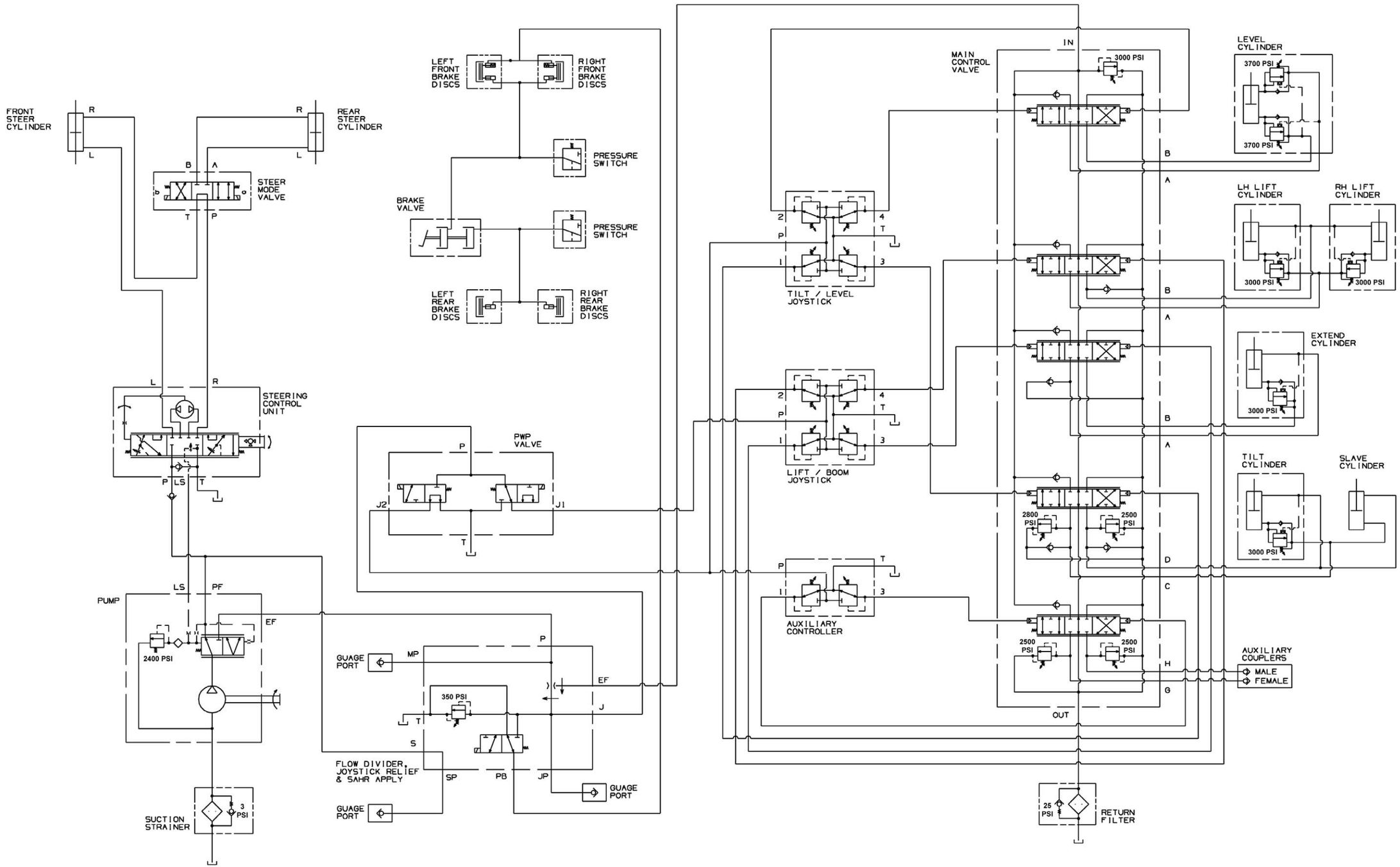
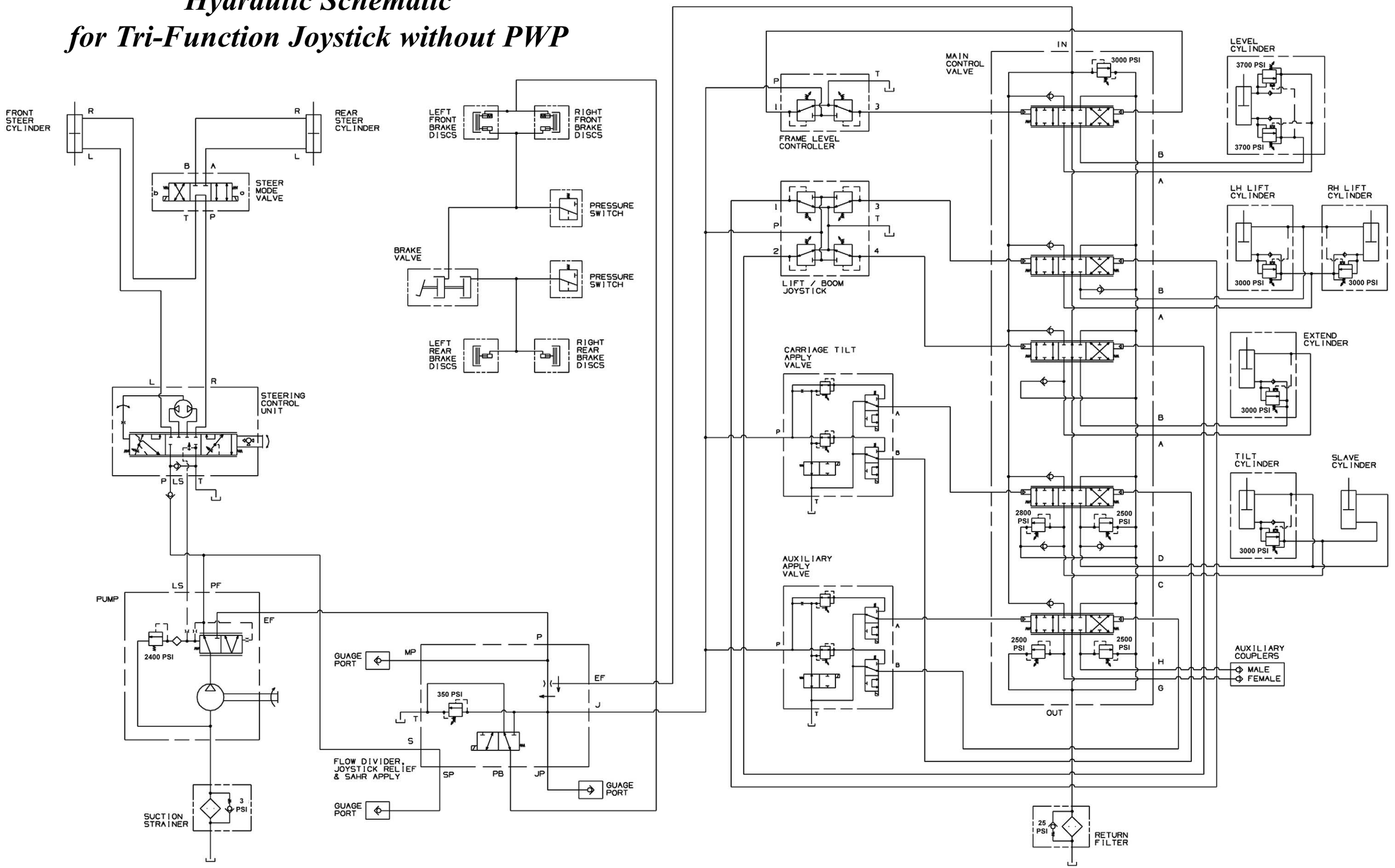
Hydraulic Schematic for Two-Joystick Controls without PWP



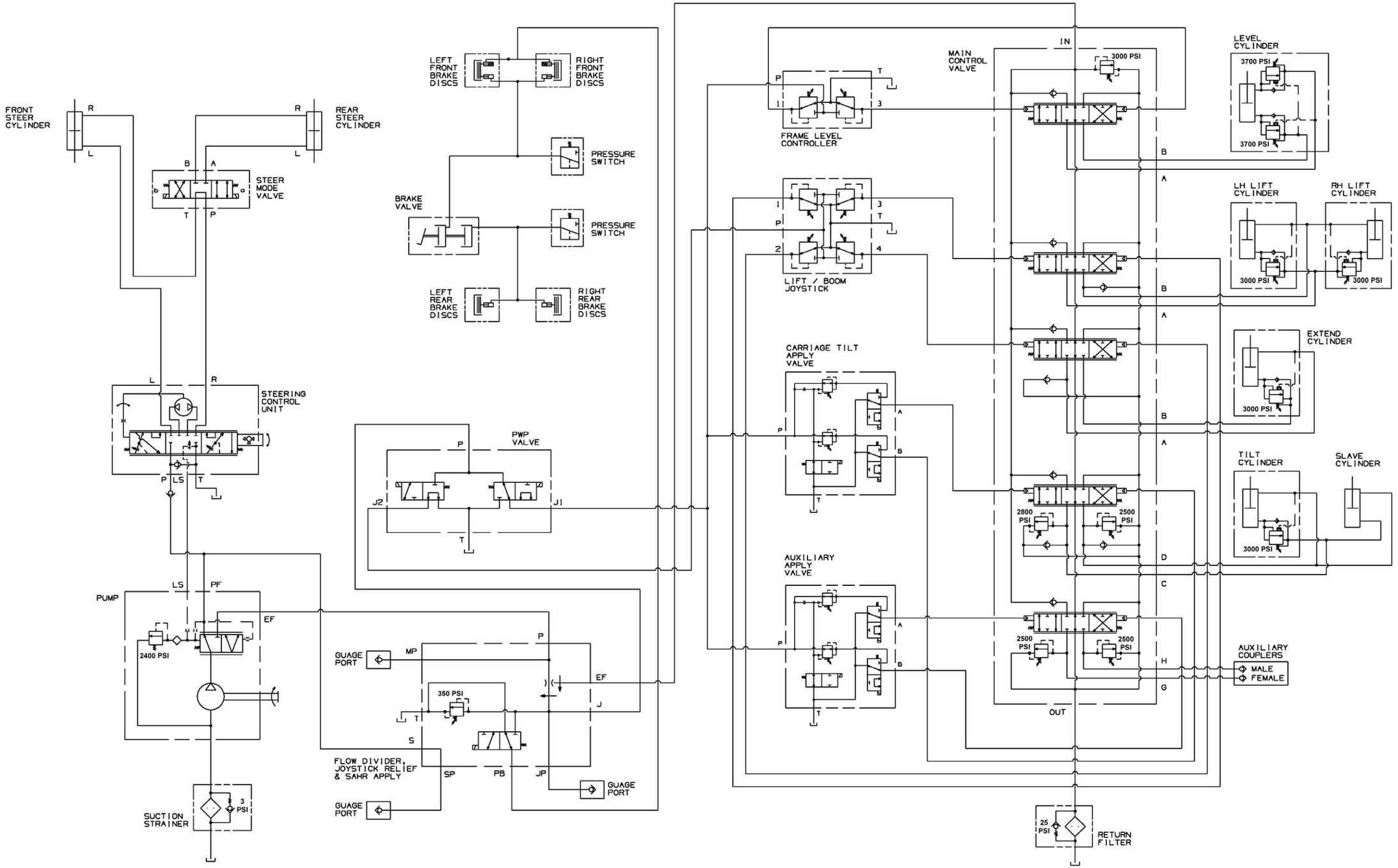
Hydraulic Schematic for Two-Joystick Controls with PWP



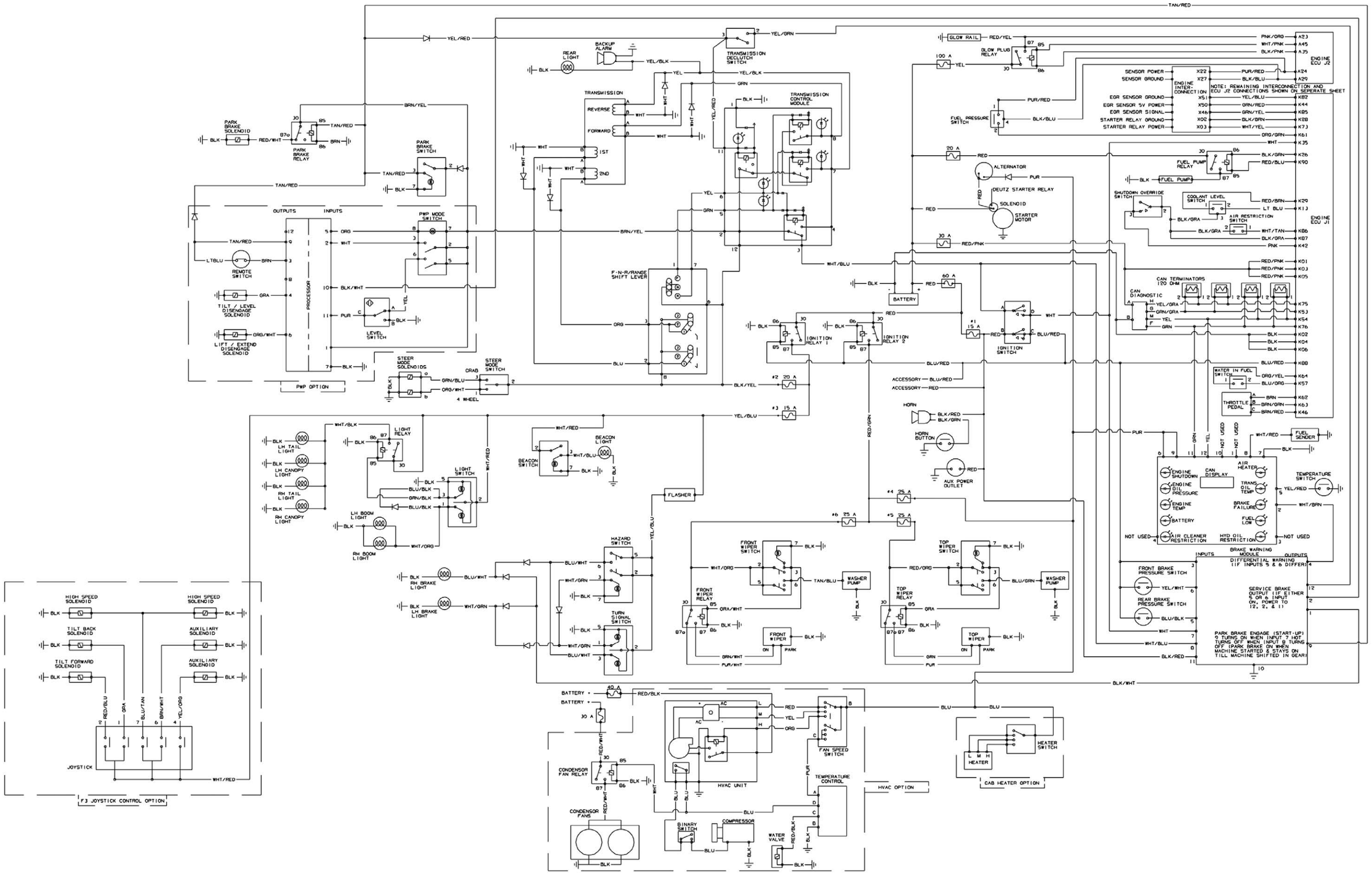
Hydraulic Schematic for Tri-Function Joystick without PWP



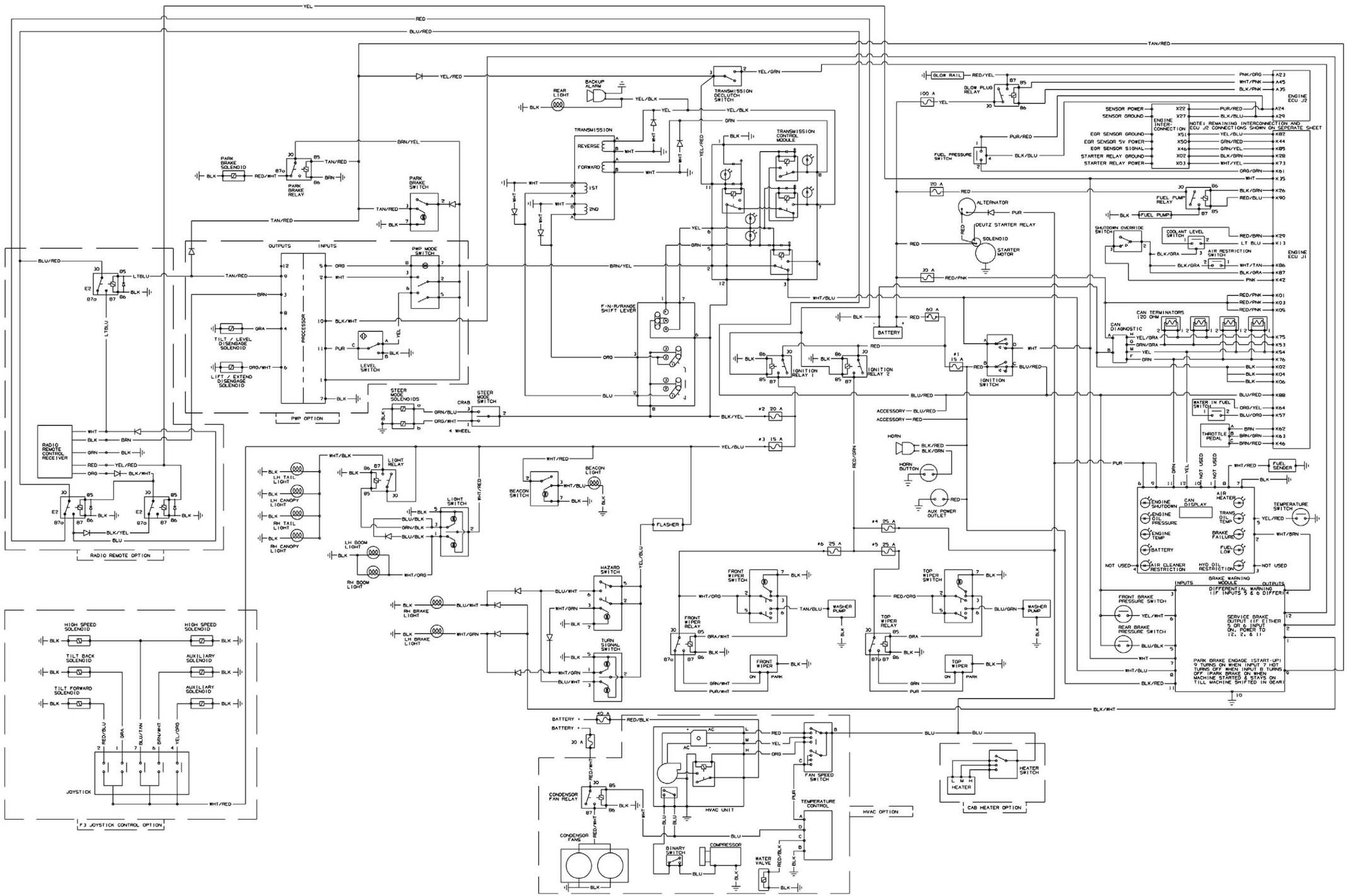
Hydraulic Schematic for Tri-Function Joystick with PWP



Electrical Schematic *(including options)*

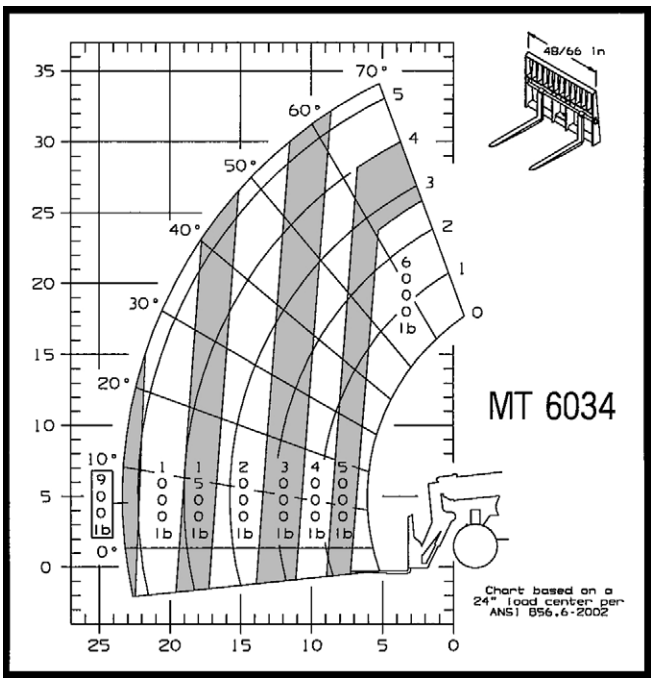


Electrical Schematic *(including options and Radio Remote)*

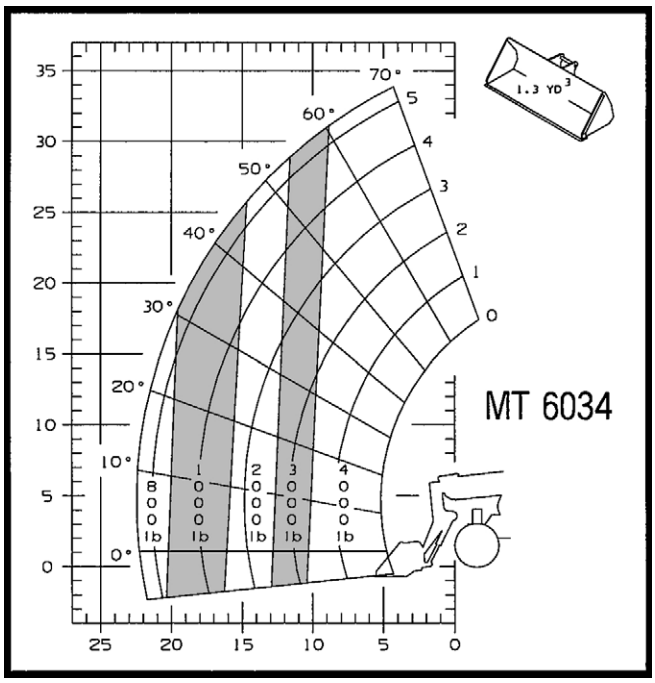


Load Zone Charts

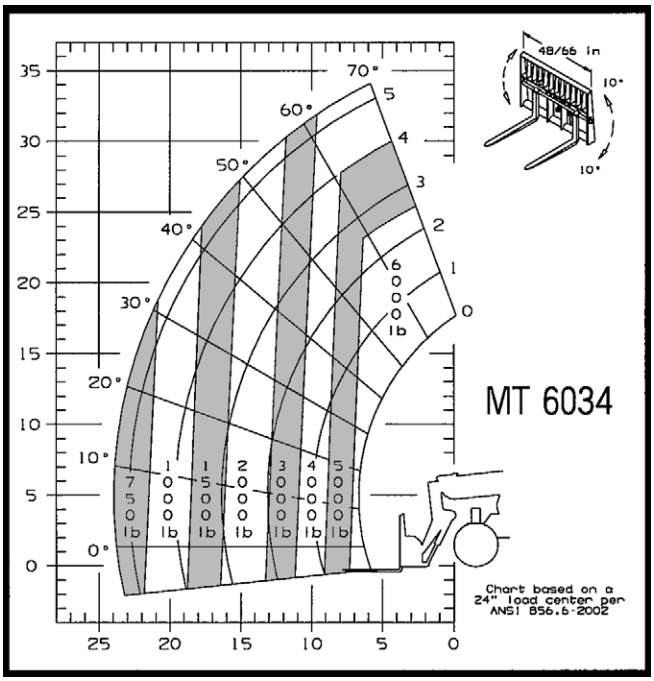
Decal 809299
Standard Carriage



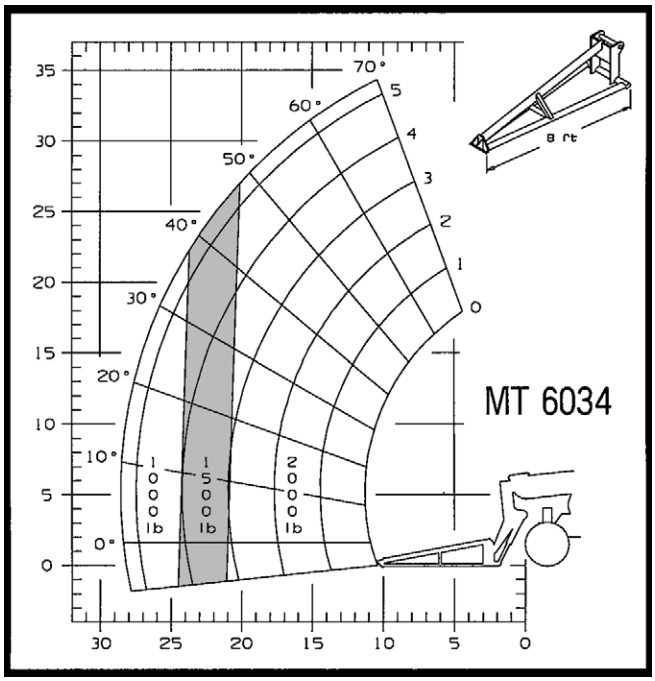
Decal 809300
1.3-Cu.-Yd. Bucket



Decal 809301
Rotating Carriage

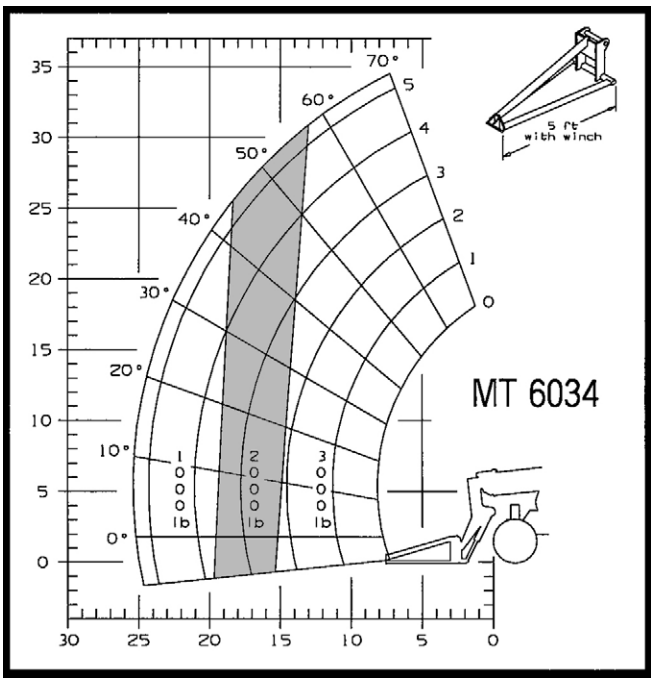


Decal 809302
8-Ft. Truss Boom

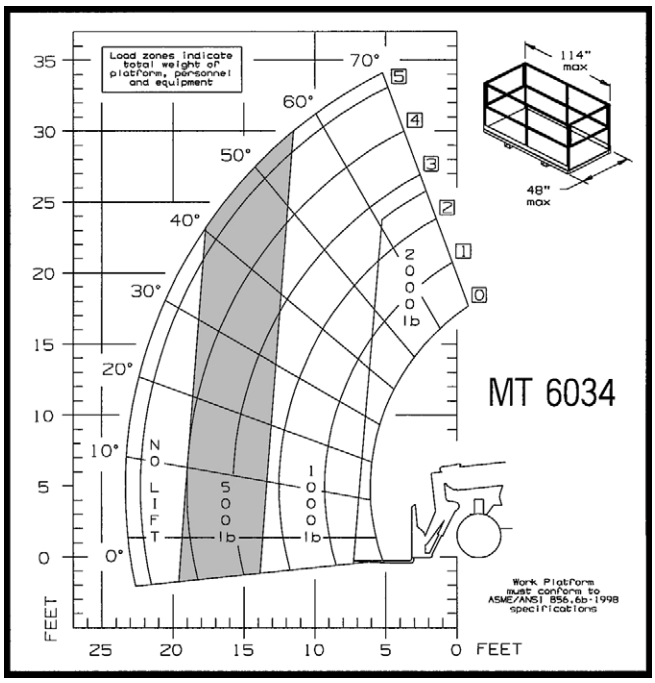


Load Zone Charts

Decal 809303
Winch Boom



Decal 809304
PWP



Torque Specifications

Use these torque values when tightening hardware (excluding: locknuts and self-tapping, thread-forming and metal screws) unless otherwise specified.

Unified National Thread	Grade 2		Grade 5		Grade 8	
	Dry	Lubed	Dry	Lubed	Dry	Lubed
8-32 8-36	19* 20*	14* 15*	30* 31*	22* 23*	41* 43*	31* 32*
10-24 10-32	27* 31*	21* 23*	43* 49*	32* 36*	60* 68*	45* 51*
1/4-20 1/4-28	66* 76*	50* 56*	9 10	75* 86*	12 14	9 10
5/16-18 5/16-24	11 12	9 9	17 19	13 14	25 25	18 20
3/8-16 3/8-24	20 23	15 17	30 35	23 25	45 50	35 35
7/16-14 7/16-20	32 36	24 27	50 55	35 40	70 80	55 60
1/2-13 1/2-20	35 40	35 40	75 90	55 65	110 120	80 90
9/16-12 9/16-18	55 60	55 60	110 120	80 90	150 170	110 130
5/8-11 5/8-18	75 85	75 85	150 180	110 130	220 240	170 180
3/4-10 3/4-16	130 150	130 150	260 300	200 220	380 420	280 320
7/8-9 7/8-14	125 140	125 140	430 470	320 360	600 660	460 500
1-8 1-14	190 210	190 210	640 710	480 530	900 1000	680 740

Metric Course Thread	Grade 8.8		Grade 10.9		Grade 12.9	
	Dry	Lubed	Dry	Lubed	Dry	Lubed
M6-1	8	6	11	7	13.5	10*
24M8-1.25	19	14	27	20	32.5	24*
M10-1.5	37.5	28	53	39	64	47
M12-1.75	65	48	91.5	67.5	111.5	82
M14-2	103.5	76.5	145.5	108	176.5	131
M16-2	158.5	117.5	223.5	165.5	271	200

* *All torque values are in lb-ft. except those marked with an *, which are in lb-in.*
For metric torque value (Nm), multiply lb-ft value x 1.355, or lb-in value x 0.113.

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MANITOU AMERICAS INC.

WARRANTY

MANITOU AMERICAS, hereinafter referred to as Manitou, warrants new Manitou equipment to the Original Retail Purchaser to be free from defects in material and workmanship for a period of twelve (12) months from the Warranty Start Date.

MANITOU WARRANTY SERVICE INCLUDES:

Genuine Manitou parts and labor costs required to repair or replace equipment at the selling dealer's business location.

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ANY OF THESE LIMITATIONS EXCLUDED BY LOCAL LAW SHALL BE DEEMED DELETED FROM THIS WARRANTY; ALL OTHER TERMS WILL CONTINUE TO APPLY.

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MANITOU WARRANTY DOES NOT INCLUDE:

1. Transportation to selling dealer's business location or, at the option of the Original Retail Purchaser, the cost of a service call.

2. Used equipment.

3. Components covered by their own non-Manitou warranties, such as tires, batteries, trade accessories and engines.

4. Normal maintenance service and expendable, high-wear items.

5. Repairs or adjustments caused by: improper use; failure to follow recommended maintenance procedures; use of unauthorized attachments; accident or other casualty.

6. Liability for incidental or consequential damages of any type, including, but not limited to lost profits or expenses of acquiring replacement equipment.

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